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IRRIGATED PASTURE AT CABOOLTURE.

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Crop-Fattened Steers Show Good Profit

By K. F. HOWARD, Adviser in Cattle Husbandry, Miles.

Can steers be fattened profitably on crops? According to a recent trial they can. Furthermore, it appears that cattle can be grazed economically on improved pasture and crops, and the result could bring about a boost in production of young, quality beef.

The trial was conducted in the Miles district to compare growth rates of steers on natural pasture with those fed on crop.

All steers were weighed regularly over a 336-day period from September, 1956, to August, 1957.

Good feed was available during spring, summer and autumn. Poor rainfall from February onwards was unfavourable to natural pasture and crop during the winter.

Steers on the relatively high plane of nutrition gained 444 lb. whilst those on natural pasture gained 227 lb.

Weight gains of steers on summer crop showed little advantage over those on natural pasture. The main difference appeared when the crop-fed steers grazed on oats.

In spite of a poor winter crop, the crop-fed steers were marketed in September, 1957, at the age of 24 months. They had an average liveweight of 961 lb. with an estimated dressed weight of 528 lb. (55 per cent. dressed). They were sold at Cannon Hill for £37 19s.

At the time the crop-fed steers were marketed, the other steers weighed 756 lb.

IN THE BRIGALOW BELT.

The trial was conducted on "Yandarlo", the property of Mr. W. D. S. Harpham. This property lies within

Plate 1.

Crop-fattened Steers Grazing Sweet Sudan in April, 1957. They weighed 891 lb. and had gained 374 lb. in 196 days.

Plate 2.

Crop-fattened Steers in August Before Marketing. The average live weight was 961 lb.

the brigalow belt and carries the typical timbers of brigalow, belah sandalwood and wilga. Box is found on the lighter soils.

Following ringbarking, the main grasses which appear are species of blue (*Dichanthium* and *Bothriochloa*) and star grasses (*Chloris*). Rhodes grass is readily established by seeding. The soil varies from a dark grey to a reddish clay loam. Most of the land is of a gently sloping nature and has the capacity to hold a fair amount of moisture.

Rainfall for the property averages 24 in. a year.

DISTRICT BEEF INDUSTRY.

The Miles district is well known as an important and productive beef cattle area. All main beef breeds are found, with Herefords and Poll Herefords predominating.

Beef raisers in the area are able to choose the type of enterprise in which to engage. Some properties breed and sell young cattle as stores, others both breed and fatten their own stock, while a third group buys stores for fattening.

Natural pasture and Rhodes grass provide the main grazing for beef cattle in the district.

DEVELOPMENT OF CROP FATTENING.

During the last five or six years there has been a marked advance in the practice of crop fattening, meaning the "topping off" on oats of cattle that are forward in condition.

Steers comprise the majority of cattle that are crop-fattened, though crop is also used for heifers and cows and calves.

Summer crops such as Sudan grass, sweet sorghums and Siberian millet are used to some extent. Winter cereal crops other than oats are sometimes used, but oats is by far the most common winter grazing crop. Canary grass is sometimes used as an alternative.

Oats is popular because in a normal season it provides a bulk of high quality feed when it is most required. Natural grasses dry off in winter, becoming fibrous and low in food value.

IMPROVED PASTURE ALSO.

Recently, some crop-fatteners have attempted to obtain high gains by the use of improved pasture plus summer and winter crops.

Grazing of oats enables them to market quality fats in the late winter and spring months. As the supply of quality cattle is usually light during the spring, prices are often higher than at other periods of the year.

The object of the trial was to compare the growth rates of two groups of steers. One group (Group A) had access to feed of above-normal quality all the time. The other group (Group B) grazed natural pasture only.

40 GOOD QUALITY STEERS.

Breeding cows on the property are carefully selected for quality, and culling standards are high. Good quality stud bulls have been used for several generations. As a result of this breeding policy the 40 steers used in the trial were well-bred animals of good quality. There were 20 steers in each group. All were dehorned Herefords.

The steers were born in August–September, 1955, and weaned in July, 1956. They were thus 12–13 months old when the trial commenced in September, 1956. At the initial weighing, Group A averaged 517 lb. compared with 529 lb for Group B.

WEIGHING.

A mobile weighbridge was used and both groups were weighed on 13 occasions at 28-day intervals. Cattle were yarded overnight, and water and feed were withheld for about 15 hours before weighing.

SEASONAL CONDITIONS.

Seasonal conditions were extreme. Rainfall for 1956 was 43.5 inches. In 1957 only 13.4 inches fell from January to September.

GRAZING CONDITIONS.

The steers in Group A, which is the crop-fed group, received the following treatment: From September to mid-December they had the remaining grazing in an oat paddock which had been used for other stock, also Rhodes grass and natural pasture. Further natural pasture was grazed until mid-January. The next grazing consisted of Sweet Sudan grass and cowpeas, and, in addition, Rhodes grass and natural pasture. Rhodes grass provided most of the grazing from mid-April to May 7.

Plate 3.

Pasture-fed Steers in April, 1957. They weighed 864 lb. and had gained 335 lb. in 196 days.

Plate 4.

Pasture-fed Steers in August. They lost 108 lb. weight since April.

From May 8 until turnoff on August 28, this group grazed on oats and natural pasture except for an 11-day period when they had to be moved because of rain.

The 1957 oat crop was very poor and at no stage did it produce much leaf. It was sown on February 1 and was not really fit for grazing in May. However stock were allowed the grazing to prevent weight loss at this stage.

The usual carrying capacity of oats is regarded as being one beast per acre but this crop carried only one beast to 2½ acres. In addition to the oats the steers were allowed ½ acre each of natural pasture. It is estimated that the crop-fed steers were carried at the rate of one beast to 4 acres over the whole period of the trial.

NATURAL PASTURE GROUP.

Group B steers grazed on land which is termed "well improved". This term implies that the timber has been ringbarked and in some places cleared; that the grass was plentiful during the growing season; and that the paddocks were relatively small. Water supply was close and plentiful at all times. In some paddocks the grass had been burned a short time before grazing.

From September, 1956, to April, 1957, the natural pastures were quite productive and Group B steers gained an average of 1.7 lb. a day each.

The food value of the natural pasture dropped sharply in May. Stock began to lose weight at that time. At the end of August they were 90 lb. lighter than they had been in the previous May.

Group B steers were carried at the rate of one beast to 6 acres.

GROWTH RATES OF BOTH GROUPS.

Plate 6 shows the growth rate of both groups and also the monthly rainfall.

During the 336 days of the trial the crop-fed steers gained 444 lb. a head for an average daily gain of 1⅓ lb.

The steers on natural pasture gained a net total of 227 lb. for an average daily gain of ⅔ lb.

From September to April there was little difference between the two groups. Then came the turning point. Even though the crop was a very poor one, the crop-fed steers gained another 58 lb., and were marketed, while the natural pasture steers lost

90 lb. and dropped back to fair store condition.

At the final weighing the crop-fed steers were 961 lb., compared with 765 lb. for the natural pasture group. The crop fed steers were sold at Cannon Hill Saleyards (Brisbane) for £37 19s. Transport and selling charges were £3 6s. a head which reduces the price of the steers on the property to £34 13s.

The steers on natural pasture were then stores and their value on a normal market was estimated at £24 a head. Under the prevailing dry conditions there was no demand for such stock at a reasonable price.

COSTS FOR CROP-FED STEERS.

A question of importance is, "What did it cost to produce this quality beef?" The costs quoted concern this particular property and set of conditions. Such factors vary considerably from property to property.

Machinery costs are based on a comparatively low-powered tractor with 3-point linkage which works an area of 250 acres a year after clearing and initial ploughing. The cost of the unit was £1,600.

With reference to land, extra expenses have been taken into account following ringbarking but with timber still standing. It is also assumed that the timber has been ringbarked for six years.

Clearing, initial ploughing and additional fencing costs were £5 an acre. If this is spread over 40 years, with interest at 6 per cent., the cost is 8s. 6d. an acre a year. Water facilities cost £650 for 500 acres. If the facilities last for 20 years the cost is 1s. 4d. an acre a year.

Plate 5.

Pasture-fed Steers Grazing on Typical Pasture in Brigalow-Belah Country in late April.

Costs to this stage are thus 9s. 10d. an acre yearly.

MACHINERY COSTS.

Actual depreciation, cost of repairs and replacements over six years averaged 5s. 6d. an hour. Fuel, oil, grease and filters cost 3s. 6d. an hour and labour costs were 8s. an hour. This gives an operating cost of 17s. an hour.

In both cases, no cost has been allowed for the normal improvements and running costs. The fencing and watering costs for the crop cattle were in addition to what would normally be required for the running of cattle on natural pasture.

In reviewing this trial it is pointed out that the economic return from crop-feeding would often be higher than in this case. On the evidence the summer grazing crop had a doubtful economic value and expenses could possibly have been reduced by not using a summer grazing crop.

The winter grazing crop was below half normal productivity and this had the effect of increasing the cost per steer by about £4 7s. Also better gains than those recorded are usually obtained from oat grazing. In another part of the district which received

ITEMISED COSTS OF PRODUCING ONE ACRE OF OATS.

	£	s.	d.
Undercutting at 1½ acres/hour		11	4
Ripping with tiller at 2½ acres/hour		6	10
Scarifying at 3 acres/hour		5	8
Sowing at 3.6 acres/hour		4	9
1 bushel of seed oats		12	0
Interest (6 per cent on £1,600 spread over 250 acres)		7	8
	£2	8	3
Add Clearing, fencing, first ploughing and water		9	10
Total	£2	18	1 per acre.

TOTAL ADDITIONAL COST PER CROP-FED STEER.

	£	s.	d.
Oats (1956) end of crop—1 acre per steer		8	0
Sudan grass and cowpeas—·9 acre per steer	1	11	6
Oats (1957)—2½ acres per steer	7	5	3
Rhodes grass—·8 acres		6	0
	£9	10	9

COMPARISON OF RETURNS.

To calculate the returns per acre for the 11-month trial period, it is necessary to place a value on the steers at the commencement of the trial. For this purpose it is supposed that the normal value of the steers would have been £16 per head for both groups.

	Group A.			Group B.		
	£	s.	d.	£	s.	d.
Value at property (August 1957)	34	13	0	24	0	0
Extra cost incurred	9	10	9			
Nett difference in value	1	2	3/head advantage			
Marketing	Sold as fats.			Carried on as stores.		
Return per head for 11 months	9	2	3	8	0	0
Return per acre	2	5	4	1	6	8

The return per acre figure is only to give a basis on which to compare the two forms of husbandry.

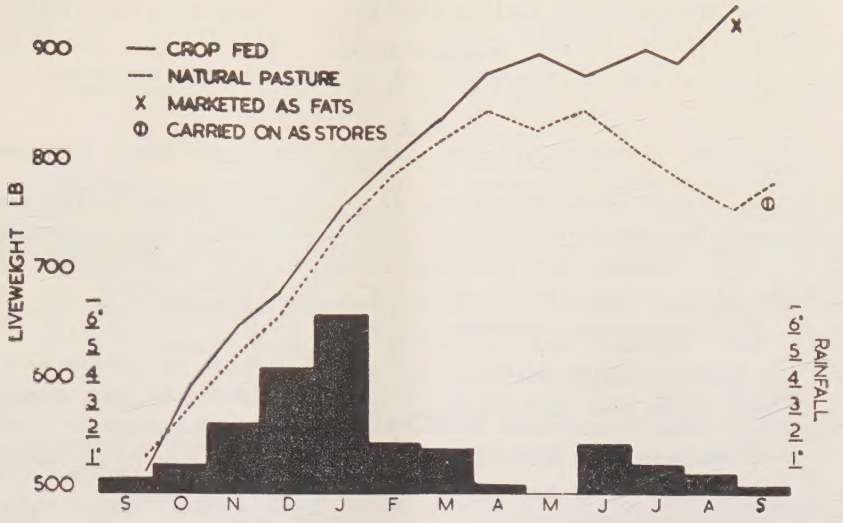


Plate 6.

Diagram Showing the Growth Rates of the Two Groups of Steers.

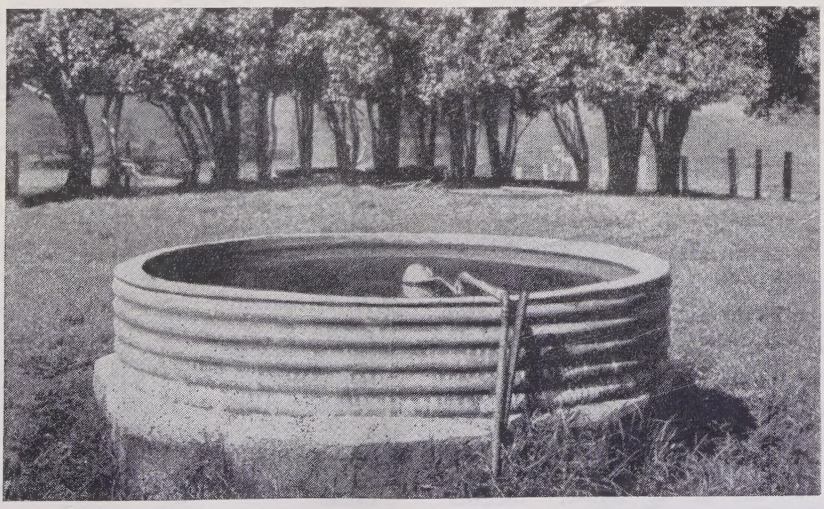
more rain, cattle on oats made gains of 2.6 lb. a day. The trial steers gained ½ lb. a day on the oats.

Economics of grazing crops and improved pasture must be assessed on a "return per acre basis" rather than a "return per beast" basis.

It appears from this trial and district experience that improved pasture and crops can be grazed economically by cattle. Such husbandry can aid in the production of young quality beef when such meat is usually in short supply.

Mr. Harpham's interest, work and co-operation in the running of this trial are gratefully acknowledged.

Water is Valuable



A Cheap Water Trough, Yet a Valuable Asset on Any Stock Farm.

Tuberculosis-Free Cattle Herds.

(As at 1st May, 1958.)

Aberdeen Angus.

G. H. & H. J. Crothers, "Moorenbah," Dirranbandi
A. G. Elliott, "Ooraine," Dirranbandi
W. H. C. Mayne, "Gibraltar," Texas

A.I.S.

M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
F. B. Sullivan, "Fermanagh," Pittsworth
D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
W. Henschell, "Yarranvale," Yarranlea
Con. O'Sullivan, "Navillus" Stud, Greenmount
H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy.
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Reushle Bros., "Reubydale" Stud, Ravensbourne
A. C. and C. R. Marquardt, "Cedar Valley," Wondai
A. H. Sokoll, "Sunny Crest" Stud, Wondai
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C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
W. H. Thompson, "Alfa Vale," Nanango
S. R. Moore, Sunnyside, West Wooroolin
H.M. State Farm, Numinbah
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
D. G. Neale, "Grovely," Greenmount
A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
W. D. Davis, "Wamba" Stud, Chinchilla
Queensland Agricultural High School and College, Lawes
C. K. Roche, Freestone, Warwick
Mrs. K. Henry, Greenmount
D. B. Green, "Deloraine" Stud, Durong, Proston
E. Evans, Wootha, Maleny
T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla
J. Crookey, "Arolla" A.I.S. Stud, Fairview, Allora
M. F. Power, "Barfield," Kapaldo
A. H. Webster, "Millievale," Derrymore
W. H. Sanderson, "Sunlit Farm," Mulgildie
R. A. and N. K. Shelton, "Vuegon" A.I.S. Stud, Hivesville, *via* Murgon
R. R. Radel & Sons, "Happy Valley," Coalstoun Lakes
C. A. Heading, "Wilga Plains," Maleny
G. S. and E. Mears, "Morden," M.S. 755, Toogoolawah

Ayrshire.

L. Holmes, "Benbecula," Yarranlea
J. N. Scott, "Auchen Eden," Camp Mountain
E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
T. F. Dunn, Alanbank, Gleneagle

Friesian.

C. H. Naumann, "Yarrabine" Stud, Yarraman
D. J. Pender, "Camelot," Lytton road, Lindum
S. E. G. Macdonald, "Freshfields," Marburg

Guernsey.

C. D. Holmes, "Springview," Yarraman
A. B. Fletcher, Cossart Vale, Boonah
W. H. Doss, Degilbo, *via* Biggenden
A. C. Swendson, Coolabunia, Box 26, Kingaroy
C. Scott, "Coralgrae," Din Din Road, Nanango
R. J. Wissemann, "Robnea," Headington Hill, Clifton
G. L. Johnson, "Old Cannindah," Monto
A. Ruge & Sons, Woowoonga, *via* Biggenden
G. Miller, Armagh Guernsey Stud, Armagh, M.S. 428, Grantham
N. H. Sanderson, "Glen Valley," Monto

Jersey.

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J. F. Lau, "Rosallen" Jersey Stud, Goombungee
G. Harley, Hopewell, M.S. 189, Kingaroy
Toowoomba Mental Hospital, Willowburn
Farm Home for Boys, Westbrook
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R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
E. A. Matthews, "Yarradale," Yarraman
A. L. Semgreen, "Tecoma," Coolabunia
L. E. Meier, "Ardath" Stud, Boonah
A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
F. W. Verrall, "Coleburn," Walloon
C. Beckingham, Trouts road, Everton Park
W. E. O. Meir and Son, "Kingsford" Stud, Alberton, *via* Yatala
G. H. Ralph, "Ryecombe," Ravensbourne
Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
J. W. Carpenter, Flagstone Creek, Helidon
H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
W. S. Kirby, Tinana, Maryborough
S. A. Cramb, Bridge st., Wilsonton, *via* Toowoomba
J. A. & E. E. Smith, "Heatherlea" Jersey Stud, Chinchilla
W. C. M. Birt, "Pine Hill" Jersey Stud, Gundiah
T. Nock, Dallarnil
P. Fowler & Sons, "Northlea," Coalstoun Lakes
F. Porter, Conondale
H.M. State Farm, Palen Creek
B. T. Seymour, "Upwell" Jersey Stud, Mulgeldie

Poll Hereford.

W. Maller, "Boreview," Pickanjinnie
J. H. Anderson, "Inverary," Yandilla
D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick.
E. W. G. McCamley, Eulogie Park, Dululu
Wilson and McDouall, Calliope Station, Calliope

Poll Shorthorn.

W. Leonard & Sons, Welltown, Goondiwindi.

That Patch of Irrigated Pasture: Will It Pay?

By E. O. BURNS, Division of Marketing.

A first look at the economics of supplementary irrigated pasture was made during November, 1957, when 18 farmers were interviewed in districts from Beaudesert to Gympie.

These farmers have been growing and feeding irrigated pasture for periods ranging from less than one year to over six years.

Only to a partial extent had irrigated pasture replaced rain-grown pasture, which was still being grazed. The main effects had been to reduce dependence on annual crops as sources of supplementary feed and to ensure a supply of feed in dry periods.

There is no doubt that irrigated pasture acts as an insurance policy in time of drought. What effect does it have on production in normal years? Here again the position appears to be favourable. Practically all the farmers interviewed have increased their production by at least 10 to 15 per cent. since they started with irrigated pasture, whilst some reported increases of 30 to 40 per cent. Although it is impossible to say to what extent these increases can be attributed to pasture irrigation alone, there is little doubt that significant increases can reasonably be expected.

So much for the gains: what about the costs of establishment and maintenance?

CAPITAL EQUIPMENT.

Capital equipment on the farms studied (converted to present-day prices) averaged slightly over £1,000. The lowest was just over £700, whilst the highest was just over £1,700. The latter, however, included a quantity of 6 in. concrete piping and some subterranean steel piping and was by no means typical. Most of the farms fell into the main range of £800 to £1,200. This does not include any cost that may be incurred in sinking bores or constructing dams. Most of the farmers interviewed in this survey irrigated from creeks or rivers.

The cost of materials was lower for flood irrigation than for spray. Capital equipment per acre for the farmers who flood exclusively ranged from £32 to £54, with an average of £44. For those who spray exclusively it ranged from £34 to £96, with an average of £64.

Budgets estimating the extra expenses involved in setting up an irrigated pasture project have been calculated from data supplied by the 18 sample farmers. Based on the experience of these farmers, they indicate the type of extra expenses that would confront a farmer to-day, who decided to go in for irrigated pasture. It is assumed that some non-irrigated pasture grazing is available in addition to the irrigated pasture.

Table 1 gives an indication of the extra capital investment necessary for areas of 10, 15 and 20 acres of irrigated pasture.

An interesting feature of the capital required is that, although the value of the pump, motor and piping varied from farm to farm, these variations did not appear to be related to the area being irrigated. The variations were caused by differences in the distance from the pump to the paddock, and in the height the water had to be lifted.

The value of these items has therefore been kept constant in the examples which follow. The average length of piping on the sample farms has been adopted—that is 14 ch. of 4 in. mainline, with an additional 10 ch. of 3 in. sprayline for farms on which spray irrigation is practised.

LABOUR.

In the establishment of the pasture, although contract labour was engaged by some farmers, normally the farmers themselves did practically all of the preparatory work. In the case of spray irrigation, labour time taken for land preparation and sowing fluctuated around six man-hours per acre.

For flood irrigation, before land can be prepared, generally it must first be graded. This results in wide variations from farm to farm, depending on the topography of the land to be graded. Times ranged on the sample farms from six hours to over 36 hours per acre. In the example, 18 man-hours per acre has been adopted.

The value of labour has been added at the foot of Table 1 as a guide to farmers who may be considering engaging labour for the purpose of establishing irrigated pasture. Naturally, there is no extra cost if the farmer can fit in the extra time himself.

ANNUAL COSTS.

Annual costs have been estimated for 10, 15 and 20 acres of pasture irrigation on the basis of a normal season, which has been assumed to be a year requiring 10 waterings each of two inches, or a total of 20 inches per acre.

There are two main types of costs —Total Costs and Extra Costs. In making decisions on the farm, the only costs that should be considered are the extra costs. Total costs include fixed costs for which the farmer is already committed, and provided a new venture will recover the extra costs incurred, it will be profitable, even if total costs are not covered.

TABLE 1.

Estimated Cost of Establishing Irrigated Pasture.

	Spray.						Flood.					
	10 Acres.		15 Acres.		20 Acres.		10 Acres.		15 Acres.		20 Acres.	
	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.
Pump and Motor ..	250	0	250	0	250	0	250	0	250	0	250	0
Piping	630	0	630	0	630	0	360	0	360	0	360	0
Fencing	40	0	50	0	60	0	40	0	50	0	60	0
Seed and Fertilizer ..	50	0	75	0	100	0	50	0	75	0	100	0
Tractor Fuel	9	0	13	10	18	0	27	0	40	10	54	0
Power for first watering	5	0	7	10	10	0	5	0	7	10	10	0
	984	0	1,026	0	1,068	0	732	0	783	0	834	0
Labour (Land Preparation and Planting, per acre, Spray, 6 hrs., Flood 18 hrs., Initial Watering 1.6 hrs.—at 5s. per hour) ..	19	0	28	10	38	0	49	0	73	10	98	0
Total Capital Cost	1,003	0	1,054	10	1,106	0	781	0	856	10	932	0
Per Acre Irrigated	100	6	70	6	55	6	78	2	57	2	46	12

In considering a pasture irrigation project, labour is the main item of difference between the two types of cost. On the normal family farm, the farmer and his family (and full time employees, in some circumstances) constitute a fixed amount of labour available throughout the year. If this labour force can cope with the work, there is no extra labour cost.

None of the farmers who were interviewed had found it necessary to engage additional labour since taking on irrigated pasture. Table 2 sets out estimated annual *extra* costs on the basis that no additional labour is needed. It is emphasized that these estimated costs would be additional to the fixed costs for which the farmer is already committed.

LABOUR.

The labour time involved can be divided into two categories; (i) Irrigation and Pasture Maintenance; and (ii) Grazing Management.

Irrigating is the most time-consuming operation in the first category. This includes starting and stopping the motor, shifting spray lines, and opening and closing bays in the case of flood irrigation.

Watering under flood conditions is less demanding of time than spray irrigation. On the sample farms, labour time for watering averaged about 23 minutes per acre-inch for flood, as against about 49 minutes per acre-inch for spray.

Other maintenance operations such as fertilizing, manure-spreading, mowing and weeding do not take up much of the sample farmers' time. Most of these farmers do not spend more than five hours per acre per annum on these jobs, but many said that they should spend more time and intended to do so in the future.

As far as grazing management is concerned, most of the farmers interviewed ration their cows to one or two grazings per day on the irrigated pasture. Labour time is spent putting cows into the pasture, turning them out, shifting electric fences, and so on. The actual time involved in these operations depends on the location of the pastures and how far away the farmer is working when it is time to open the gate.

The experience of most of the farmers was that this would not take more than an average of half an hour to an hour each day. The amount of labour utilised in this manner is not varied greatly by the size of the herd or the extent of the pastures.

TABLE 2.

Estimated Annual Extra Costs of Pasture Irrigation.

	Spray.									Flood.								
	10 Acres.			15 Acres.			20 Acres.			10 Acres.			15 Acres.			20 Acres.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Interest ..	25	1	6	26	7	3	27	13	0	19	5	6	21	8	3	23	6	0
Depreciation	81	13	4	82	3	4	82	13	4	54	13	4	55	3	4	55	13	4
Repairs ..	26	3	0	31	18	0	37	13	0	19	8	0	23	16	0	28	4	0
Power ..	50	0	0	75	0	0	100	0	0	50	0	0	75	0	0	100	0	0
Fertilizer ..	9	0	0	13	10	0	18	0	0	9	0	0	13	10	0	18	0	0
	191	17	10	228	18	7	265	19	4	152	6	10	188	17	7	225	3	4
Per Acre Irrigated	19	3	9	15	5	3	13	6	0	15	4	8	12	11	10	11	5	2

TABLE 3.

Estimated Annual Labour Requirements for Pasture Irrigation (Man-hours).

	Spray.			Flood.		
	10 Acres.	15 Acres.	20 Acres.	10 Acres.	15 Acres.	20 Acres.
Watering	162	243	324	76	114	152
Fertilizing	5	7	10	5	7	10
Manure-spreading	20	30	40	20	30	40
Mowing	20	30	40	20	30	40
Weeding, &c.	30	45	60	30	45	60
Grazing Management	274	274	274	274	274	274
	511	629	748	425	500	576
Per Acre Irrigated	51	42	37	42	33	29
Average per day	1.4	1.7	2.0	1.2	1.4	1.6

SEASONAL CONDITIONS.

The analysis so far has been based on a normal year, which it is assumed necessitates 10 applications each of two inches.

Table 4 attempts to depict the variation in probable costs caused by seasonal conditions. Estimates of annual costs are made for 15 acres of spray irrigation in a good season (five sprayings—total 10 inches), normal season (10 sprayings—total 20 inches), and poor season (15 sprayings—total 30 inches). The "normal season" data are taken from Tables 2 and 3.

TABLE 4.

Estimated Annual Costs for Good, Normal and Poor Seasons—15 Acres Spray Irrigation.

	Good Season.	Normal Season.	Poor Season.
	£ s. d.	£ s. d.	£ s. d.
Interest	26 7 3	26 7 3	26 7 3
Depreciation	82 3 4	82 3 4	82 3 4
Repairs	23 8 6	31 18 0	40 7 6
Power	37 10 0	75 0 0	112 10 0
Fertilizer	13 10 0	13 10 0	13 10 0
	182 19 1	228 18 7	274 18 1
Per Acre Irrigated	12 3 11	15 5 1	18 6 6
	Man-hours.	Man-hours.	Man-hours.
Labour—			
Watering	121	243	364
Other	386	386	386
	507	629	750
Per Acre Irrigated	34	42	50
Average per day	1.4	1.7	2.1

REDUCTION IN ANNUAL CROPPING.

Tables 2 and 3 estimate the annual costs and the labour time involved in an irrigated pasture project in a normal year. Viewing the whole farm as a single unit, it will generally be found that there are savings in costs and labour time to be offset against these. Annual fodder crops had been grown on all the sample farms prior to pasture irrigation, and the typical position is that the area of these crops has been reduced or the practice discontinued.

The general experience of the farmers interviewed is that one acre of irrigated pasture substitutes for a total of about two and a half acres of crops, which would include some summer and some winter feed. On this basis, estimated savings in seed, fertilizer, tractor fuel and labour which would have gone into replaced fodder crops are set out in Table 5.

EFFECT ON PRODUCTION.

It was not possible from the data collected in this survey to measure accurately the effect which irrigated pasture has had on production. This could only be derived from controlled experimentation.

Nevertheless, the general experience of the sample farmers has been that their normal production level has increased by at least 10 to 15 per cent., whilst some have made quite spectacular gains of the order of 30 to 40 per cent. It is impossible to gauge how much of this can be attributed directly to an improvement in feeding, and how much to other factors.

Although it appears that an increase in production of at least 10 to 15 per cent. can be expected in normal circumstances, relative gains to be made in a year of drought would be considerably greater. Production on practically all of the sample farms was either maintained or increased during the 1957-58 drought, despite the fact that overall production dropped.

Table 6 attempts to provide a guide to the financial results that could be expected from the establishment of irrigated pasture. Because there are other factors involved such as managerial ability, estimated profits have been calculated for increases in production ranging from 10 to 40 per cent. Most of the increases recorded on the sample farms came within this range.

TABLE 5.

ESTIMATED ANNUAL COSTS AND LABOUR FOR CROPS REPLACED BY IRRIGATED PASTURE.

Area of Irrigated Pasture .. .. .. acres	10	15	20
Area of Replaced Fodder Crops .. .. acres	25	37½	50
	£ s.	£ s.	£ s.
Annual Cost of Replaced Fodder Crops—			
Seed and Fertilizer	50 0	75 0	100 0
Tractor Fuel	22 10	33 15	45 0
	72 10	108 15	145 0
Labour for Replaced Fodder Crops—			
Preparation and Planting .. man-hours	150	225	300
Grazing Management .. .. man-hours	122	122	122
Harvesting, Haymaking .. man-hours	25	37	50
	297	384	472

The calculations have been made on the following assumptions:—

(1) 15 acres of irrigated pasture;

(2) 40 cows averaging 200 lb. commercial butter prior to pasture irrigation;

(3) 1 acre of irrigated pasture to replace 2½ acres of annual crops;

(4) Rain-grown pasture also available;

(5) 10 waterings, each of 2 in., per annum.

These budgets indicate that, in all the circumstances outlined, irrigated pasture should at least pay for itself in a normal year. The extra labour involved in transferring from crops to irrigated pasture averages out at less than an hour a day, although this comes in uneven bursts, being naturally much heavier whilst irrigating. Even if it was necessary to pay for the extra labour needed, the project would still be profitable in all the situations set out, with the exception of the 10 per cent. increase with spray irrigation. A minimum increase in

TABLE 6.

Estimated Annual Profits from 15 Acres Irrigated Pasture, Assuming Increased Production Ranging from 10 to 40 Per Cent.

	Spray.				Flood.			
	Increased Production.				Increased Production.			
	10%.	20%.	30%.	40%.	10%.	20%.	30%.	40%.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Production before Irrigated Pasture	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
Production after Irrigated Pasture	8,800	9,600	10,400	11,200	8,800	9,600	10,400	11,200
Increase in Production ..	800	1,600	2,400	3,200	800	1,600	2,400	3,200
	£	£	£	£	£	£	£	£
Value of Increased Production* ..	133	267	400	533	133	267	400	533
Saving on Replaced Crops	109	109	109	109	109	109	109	109
	242	376	509	642	242	376	509	642
Annual Costs ..	229	229	229	229	189	189	189	189
Annual Profit ..	13	147	280	413	53	187	320	453
Labour—								
Man-hours for Irrigation ..	629				500			
Man-hours for Replaced Crops ..	384				384			
Annual Extra Man-hours..	245				116			

* On the basis of 3s. 4d. per lb. commercial butter.

production of 14 per cent. would be necessary in these assumed conditions to cover the cost of extra labour.

The area of 15 acres selected for this analysis was typical of the survey farms. It was not possible in this survey to arrive at any conclusions as to the optimum area of irrigated pasture. It seems reasonable to conclude, however, that given satisfactory management and adjustment of herd size to carrying capacity, a larger area should prove more profitable.

On the other hand, an area much smaller than 15 acres should probably be viewed more in the nature of insurance against drought. The standard of management necessary to turn the small area to profitable account in a normal season would be higher than with the larger area, because of the high proportion of fixed costs involved in any irrigation project.

ASSUMPTIONS.

The following assumptions have been used in preparing these budgets, in addition to those mentioned in the article.

Irrigation Piping—14 ch. 4-in. mainline at £6 14s. a length (17ft. 6in.). For spray, 10 ch. 3-in. sprayline at £5 16s. 6d. a length, in addition to the mainline. Sprays, bends, etc., valued at £62 5s. for spray farms. Incidentals for flood farms valued at £13 12s.

Fencing.—Electric fence £20, plus £2 per acre irrigated for subdividing fences.

Feed and Fertilizer.—£5 per acre planted. Annual fertilizer, 1½ cwt. superphosphate per acre at 12s. per cwt. For replaced crops, seed and fertilizer valued at £2 per acre.

Tractor Fuel.—3s. per hour.

Power for Irrigating.—5s. per acre inch.

Labour Value.—5s. per man-hour.

Depreciation.—Equal annual instalments based on estimated effective life —Pump and motor, 15 years; piping, etc., 10 years; fencing, 20 years.

Repairs.—Pump and motor 2 per cent. of valuation, plus an additional 1 per cent. per 100 acre-inches applied; Piping 1½ per cent. of valuation, plus ½ per cent. per 100 acre-inches applied; Fencing, 1 per cent. of valuation.

Interest.—5 per cent. on half capital value.

Labour Times.—Man-hours per acre per annum:—Fertilizing ½, manure-spreading 2, mowing 2, weeding 3. Grazing management, irrigated pasture ¾ man-hour per day. Land preparation and sowing, replaced crops, 6 man-hours per acre, feeding out, replaced crops, 20 minutes per day, harvesting, haymaking, replaced crops, 2½ man-hours per acre per annum.

WHICH STRAIN OF BUFFEL?

Question: "T.M.", of Gatton, inquires if the Gayndah strain and West Australian strain of buffel grass would suit his district.

Answer: Experience with the West Australian strain of buffel grass growing under Queensland conditions seems to indicate that it is not likely to be a successful grass in the Lockyer district. The Gayndah strain would be far more suitable for that district.

—Agriculture Branch.

Brucellosis-Tested Swine Herds

(As at 1st May, 1958.)

Berkshire.

A. P. and N. Beatty, "Deepdene," Barambah road, Nanango
S. Cochrane, "Stanroy" Stud, Felton
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
G. C. Traves, "Wynwood" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Beau View" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, Middle Creek, Pomona
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
G. L. Gabanko and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
C. E. Edwards, "Spring Valley" Stud, Kingaroy
V. F. Weier, "SA Crescent," Clifton
B. Osborne and Dr. J. W. Best, Miltown Stud Piggery, Warwick
W. Young, Kybong, via Gympie
H. H. Sellars, "Allambie" Stud, Tabooba, Beaudesert
E. J. Clarke, Mt. Alford, *via* Boonah
G. McLennan, "Murcott" Stud, Willowvale
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
E. R. Kimber, Block 11, Mundubbera
A. J. Potter, "Woodlands," Inglewood
Regional Experiment Station, Hermitage
J. W. Bukowski, "Secreto" Stud, Oxley
R. Astbury, "Rangvilla," Pechey
L. Pick, Mulgildie
D. G. Grayson, Killarney
A. French, "Wilson Park," Pittsworth
D. Ludwig, Cainable, via Beaudesert
J. & S. Kahler, East Nanango

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood.
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood.
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
W. Zahnow, Rosevale, *via* Rosewood
Regional Experiment Station, Biloela
G. J. Hutton, "Grajea" Stud, Cabarlah
H. L. Larsen, "Oakway," Kingaroy
A. Palmer, "Remlap," Greenmount
G. I. Skyring, "Bellwood" Stud, *via* Pomona
G. Pampling, Watch Box road, Goomeri
M. Hall, "Milena" Stud, D'Aguilar
K. B. Jones, "Cefn" Stud, Pilton road, Clifton
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
C. Wharton, "Central Burnett" Stud, Gayndah
S. Jensen, Rosevale, *via* Rosewood
V. V. Radel, Coalstoun Lakes
H. R. Stanton, Tansey, *via* Goomeri
L. Stewart, Mulgowie, *via* Laidley
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy
B. F. Jensen, Rosevale
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes, Brisbane
R. Kennard, Collar Stud, Warwick
A. C. H. Gibbons, Mt. Glorious
A. Kanowski, "Exton," Pechey
L. C. and E. Wieland, Lower Cressbrook
P. L. and M. T. D. Hansen, "Regal" Stud, Oaklands, Rangeville, Toowoomba.
P. F. Ives, Capalaba
D. Ludwig, Cainable, via Beaudesert
J. C. Lees, "Bridge View" Stud, Yandina
R. Rhodie, Clifton

Tamworth.

D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
Department of Agriculture and Stock, Regional Experiment Station, Kairi
F. N. Hales, Kerry road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
H. J. Armstrong, "Alhambra," Crownthorpe, Murgon
R. H. Coller, Tallegalla, *via* Rosewood
D. V. and P. V. Campbell, "Lawn Hill," Lamington
S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
L. C. and E. Wieland, Lower Cressbrook

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
C. R. Smith, "Belton Park" Stud, Nara
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
"Wattledale" Stud, 492 Beenleigh road, Sunnybank
Kruger and Sons, "Greyhurst," Goombungee
A. Scott, "Wanstead" Stud, Grantham
G. C. Burnett, "Rathburnie," Linville
R. A. Collings, "Rutholme" Stud, Waterford

British Black.

E. Pointon, Goomburra

The Cleanest Way To Produce Milk

By G. G. CRITTALL, Dairy Research Branch.

More and more importance is now being placed, by both local and overseas testing authorities, on the presence of extraneous matter in dairy products, and it has been found that most foreign matter gains access to the milk or cream supply in the course of production on the farm.

Dry seasonal conditions, dust, and variable quality water supplies are all potent sources of contamination and add to the farmer's production difficulties. Nevertheless, as milk is a valuable and most important food, every precaution is necessary to ensure that it is produced in the cleanest possible manner.

Whilst cream filtration devices have been evolved for factories, prevention is surely better than cure. Sediment tests for cream have made it possible to pin-point sources of contamination on the farm.

Investigations made on a number of farms have included sediment tests on one pint samples of milk taken: (*a*) directly from the releaser; (*b*) from the milk vat just before separation; and (*c*) from hand strippings.

The cream from the separator was tested for sediment, as well as the separated milk (*d*). Following storage on the farm, further cream samples were taken (*e*), and again on arrival at the factory grading platform (*f*).

Results of examination of these various samples gave an indication of the most prevalent sources of contamination and likely control measures.

RESULTS OF TESTS.

(*a*) *Milk from releaser.*

Generally the milk as sampled directly from the releaser was fairly clean (Plate 1). However, the milk from one farm, examined during wet and muddy conditions, showed a fair amount of dirt (Plate 2), despite the

Plate 1.

Sediment Test of Milk Taken from Releaser.

Plate 2.

Milk Taken from Releaser. The udders were muddy; not thoroughly washed.

Plate 3.

Milk Taken from Releaser. Udders muddy, but more attention given to washing.

washing of udders before milking. The cows in this particular herd had been walking in mud up to their flanks and it was quite a problem ensuring that not only the teats, but the whole udder, were free of mud. A sediment test taken as milking progressed, with more attention to udder washing, showed improved results (Plate 3).

(*b*) *Hand Strippings.*

In all cases hand stripping samples contained much extraneous matter, showing plant material, dust and numerous animal hairs (Plate 4). Such a result emphasises the value of machine stripping in preference to hand stripping. Although such a practice has been favourably reported upon previously it is desired to emphasise that hand stripping should be avoided if only because of the increased sediment added to the milk.

(*c*) *Milk from the Vat.*

Samples taken from the milk vat just before separating showed variable results; some results were similar to the milk taken from the releaser, whilst others showed an increase in sediment. Portion of this increase was due to the sediment added with the hand strippings, but much of it was due to dust blown into the open vat. Material found included pieces of feed from feed storage bays or dust from the nearby yards, depending largely on the direction of the wind at the time of milking. Plate 5 shows the results of a sediment test on a sample taken from the vat with hand strippings included.

(*d*) *Cream from Separator.*

Workers in Victoria found that the normal cream separator is a very good clarifier and both the skim-milk and cream taken from a separator contain

Plate 4.
Hand Strippings.

Plate 5.
Milk from Vat.

little extraneous matter. This was confirmed on one farm, but on another the cream showed extraneous matter, although the separated milk showed no foreign matter.

It is possible for such dirt to have come from the spout of the separator, as tests at a later date showed clean cream. Cream taken directly from the separator should be clean, unless the separator discs are extremely close together or the discs clogged with sludge, in which case the machine would give a poor performance.

(*e*) *Cream after farm storage.*

Under Regulation 41 of the Dairy Produce Acts, "the owner of milk and/or cream kept in 'Dairy House A' or a milk stand shall protect all such milk and/or cream by a lid made of fly-proof brass woven wire of No. 12 mesh and No. 24 gauge, or other approved material, attached to an approved metal rim. The whole shall fit in such a manner as to prevent rodents, insects and dust from entering the container." This care and protection of the milk or cream is essential if the product is to be kept clean and wholesome. The occurrence of ants and flies in cream at times is considered due to inadequate protection during storage on the farm or from the can before the cream is added. During the summer months, ants and flies are prevalent and the milk or cream should be stored as mentioned to prevent their access to the product.

(*f*) *Transport of cream to factory.*

On dry dusty roads cans of cream and milk often become quite dusty on the outside. Dust gathers particularly on the lids and shoulders of the cans. Some of this dust may find its way into the can itself, particularly with cans having ill-fitting lids. Some factories before removing the lids and tipping hose the outside of the cans to prevent any of this dust falling into the vat. A comparison of the extraneous matter in the cream before leaving the farm and after arrival at the factory is shown in Plates 6 and 7, and Plate 8 shows the results of the sediment test performed on a sample of a clean cream taken from another supplier's can on the factory platform. Much of the extraneous matter shown in Plate 7 was on the lid of the can and gained access to the cream when the lid was removed for grading.

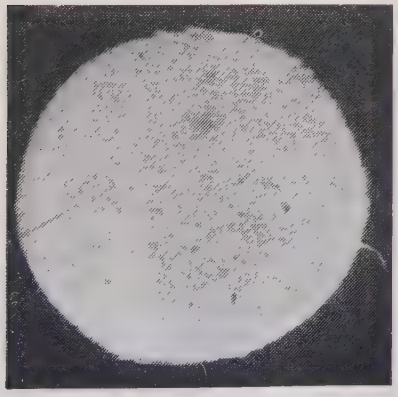

Plate 6.

Sediment Test of Cream before Departure from Farm.

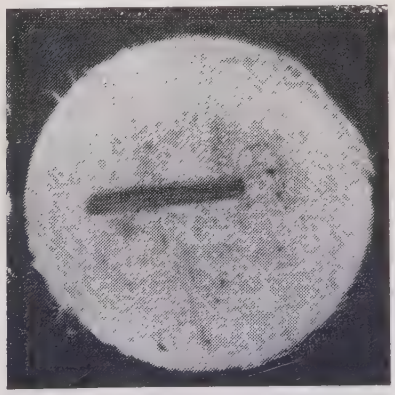

Plate 7.

Same Cream as in Plate 6 on Arrival at Factory.

HERE ARE THE REMEDIES.

In order to produce cream of the desired quality the following steps should be undertaken by all farmers:

(1) Rinse all equipment, buckets, cans, releaser, vat and separator spout before use with clean, preferably chlorinated, water.

(2) Thoroughly wash the teats and the whole udder of the cow before milking.

(3) Strip cows by machine and not by hand.

(4) Keep the milk vat covered as much as possible during actual milking and separating operations to ensure no contamination from dusty yards and wind-blown feed.

(5) Check the separator to see that the cream produced is free of dirt. This can be done by a sediment test, and not by examination of the sludge in the bowl.

(6) Protect the cream in the can by approved gauze covers and store in such a manner as to prevent insect and dust contamination.

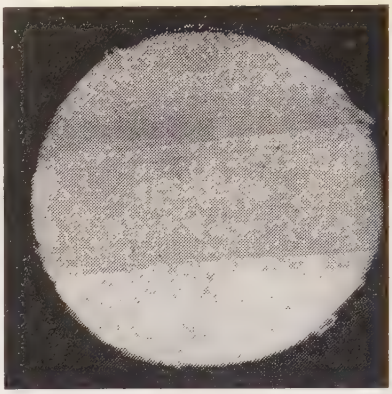

Plate 8.
Clean Cream on Arrival at Factory.

(7) Fit cans with the correct lids. preferably of a hooded or mushroom type, to keep the contents free from dust en route to the factory.

It is a wise practice for all cream cans to be thoroughly hosed on arrival at the factory to remove any accumulated dust from the lids and sides.

HOT WATER FOR DAIRY CLEANING.

What types of hot water boilers are recommended for dairy use? This question was asked in a recent Farmers' Forum Quiz in the Burnett district.

There are three types of boilers that are approved for use in dairies:

(1) *Set-in open boiler (copper)*—This boiler must be placed within 15 ft. of the separator room or dairy house.

If used on a farm where the cows are milked by hand, 12 gal. capacity is sufficient. If the cows are milked by machine then the copper must have the same minimum capacity as is required for electric dairy water heaters.

(2) *Steam Sterilizers*—(*a*) Pressure type. Cannot be placed in the milk or separator room. An outside annex or lean-to is required to house this type. (*b*) Atmospheric pressure type. Must be located as indicated in (*a*) and must have the same minimum capacity as is required for electric dairy water heaters.

(3) *Electric Dairy Water Heaters*—These can be placed in the milk or separator room. They must be specially designed for dairy use. A domestic unit is not approved. If the milking machine has three sets of teatcups or less, 14 gal. draw-off capacity is required. With more than three sets of teatcups, 18 gal. draw-off is the minimum allowed. The thermostat must be set at 180 deg. F. and the "booster" switch, which incidentally only makes the thermostat inoperative and does not switch in any extra elements, should be so set to ensure that the 14 or 18 gal. can be boiled for sterilizing operations within a reasonable time.

—*J. D. ELRINGTON, Senior Adviser, Machinery.*

The Thermoduric Test For Market Milk

By L. G. LIGHTBODY, Dairy Research Branch.

When milk is pasteurised for market it is heated to 163 deg. F. for 15 seconds. This heat kills most bacteria, except some that resist high temperatures. These are known as thermoduric organisms.

These thermoduric organisms mostly come from the dairy; from equipment that is not properly cleaned and sterilized.

This article explains the thermoduric count, and gives six helpful steps that dairymen may take to keep the count down, that is, to keep the raw milk pure.

The term thermoduric does not refer to any particular species of bacteria, but includes many different types. It is simply used in dairying to cover the bacterial types which survive the temperatures used for commercial pasteurisation.

EFFECT ON MILK QUALITY.

Bacteria which are found in pasteurised milk are either thermoduric types which originated in the raw milk and which have not been destroyed by the heat treatment, or contaminants which have entered the milk after pasteurisation. If factory hygiene is good, the numbers of bacteria gaining entry after pasteurisation will be very small and the bacteria present will be mainly thermoduric organisms.

Legal standards for pasteurised milk in Queensland include the requirement that the total bacterial count be less than 50,000 per millilitre. For pasteurised milk to comply with this standard the raw milk being received by the factory must not contain large numbers of thermoduric bacteria. Pasteurised milk quality is affected to a smaller extent by thermoduric organisms than by many contaminant types, including coliform organisms. However, large numbers of thermoduric bacteria will lower the keeping quality, and their presence is undesirable.

FROM FARM UTENSILS.

Research has shown that thermoduric organisms in raw milk arise in the dairy. The immediate source is farm utensils, with milking machines involved more often than other equipment. Small numbers are always present in the surroundings, but provided that cleaning and sterilizing procedures are adequate, the numbers which enter the milk will not be very great. Therefore, high thermoduric counts in the milk indicate that contamination is taking place from equipment that is not properly cleaned and sterilized.

It must be remembered that these organisms survive temperatures in the region of 160-170 deg. F., and that temperatures near boiling point (212 deg. F.) are needed for their destruction. If the amount of boiling water used is not sufficient the temperature will soon drop, and these bacteria will meet warm, moist conditions which favour their development. The bacterial numbers will then increase, instead of the organisms being destroyed.

No surface can be sterilized unless it is cleaned first. When deposits are allowed to accumulate on the surface of equipment or in the crevices of worn rubberware, bacteria in the

deposits are partially protected from the boiling water. The amount of heat which can reach individual bacterial cells is not sufficient to destroy them. The penetrative power of chlorine solutions is even less than that of boiling water. Therefore, deposits must be eliminated from machines and other equipment as a first step in the control of thermoduric organisms in the dairy.

METHODS OF CONTROL.

Once the nature of these organisms, and reasons for their presence, are understood, the steps which must be taken to eliminate them are apparent. Briefly these steps are as follows:

1. Replace faulty utensils and badly worn or cracked rubberware.

2. Remove all milkstone and deposits from milking machines and other equipment.

3. Use recommended procedures for cleaning equipment to prevent any further accumulation of deposits.

4. Sterilize machines and other utensils after cleaning, using adequate quantities of *boiling water* or steam.

5. Allow equipment to drain and dry. Remember that moist conditions favour bacterial growth.

6. Just before milking, rinse with chlorine solutions of recommended strength to destroy any contamination that may have occurred from the air or dust after the sterilization with boiling water.

THE THERMODURIC COUNT.

Raw milk samples which are to be examined for thermoduric count are first pasteurised in the laboratory. This is usually done by holding the samples at 145 deg. F. for 30 minutes and then cooling them quickly. The only bacterial types now remaining in the samples will be thermoduric organisms.

The number of bacteria is estimated by the roll-tube method. A calibrated loop which holds 1/1,000 millilitre of milk is used to transfer this amount of sample to a sterile agar medium which contains substances which will support the growth of bacteria. The agar medium is first melted by boiling, and then cooled to 113 deg. F. At this temperature it remains liquid but will not affect the organisms inoculated into it. The inoculated tube is rolled on a block of ice until the agar sets in a thin layer around the tube. The prepared roll-tubes are incubated at 90 deg. F. for two days.

The bacteria in this agar medium multiply rapidly so that a colony containing many million cells forms from each bacterium. These colonies can be seen with the naked eye and are counted. When the number of colonies is multiplied by 1,000, the number of bacteria per millilitre in the sample is obtained.

METHYLENE BLUE TEST.

The thermoduric count and the methylene blue test are both tests applied to raw milk, but there is no connection between the two. The tests measure different aspects of raw milk quality.

Farmers may wonder why milk can be of unsatisfactory quality in regard to thermoduric count, although satisfying the standard for methylene blue reduction time.

The reason for this is that thermoduric organisms reduce methylene blue only slowly. Milk with a high thermoduric count will not reduce methylene blue within four hours, unless it is also contaminated with other types of organisms.

The methylene blue reduction time is lowered by the presence of many different types of organisms which are

not thermoduric. These include normal milk-souring types, bacteria and cells from mastitis infections, and contaminants arising from dust, manure or water.

Although these types may be present in sufficient numbers to cause a low methylene blue reduction time they will not contribute to the thermoduric count.

In addition, contamination from utensils may not necessarily include thermoduric types. Therefore, it can be seen that milk may have a low methylene blue time from some cause without having a high thermoduric count.

Raw milk for the market milk trade should be of satisfactory quality with regard to both the methylene blue test and the thermoduric count.

WHAT THE COUNT MEANS.

Thermoduric organisms do not grow rapidly in raw milk and the thermoduric count is not significantly affected when milk is stored at atmospheric temperatures for several hours. Storage of milk overnight at refrigeration temperatures is also without effect. For these reasons, the thermoduric count is a very good indication of the conditions of milk production on the farm, a high count indicating improperly cleaned equipment or defective rubberware.

It should not be difficult for any farmer to supply milk which satisfies the desired requirements for thermoduric bacteria in raw milk provided the recommended procedures of cleaning and sterilizing milking machines and other equipment are carefully followed.

Treat it Now!

This cow has "lumpy jaw". That bony swelling on her right jaw is the site of infection. The germ has caused swollen bone and pus. From a small lump, it grows quickly to the size indicated in the picture. "Lumpy jaw" is infectious, especially when it bursts. With modern drugs your veterinary surgeon can treat this well in the early stages. Even when a "lumpy jaw" has progressed to an advanced stage, treatment can heal it up so that the cow is not a total loss.

—W. R. RAMSAY, Veterinary Officer.

Try These Easy-to-Work Bails For Calf Feeding

By W. F. MAWSON, Cattle Husbandry Branch, and C. T. GIBBS, Dairy Officer.

The use by dairymen of suitable calf feeding bails can save time and temper over many years.

Easy-to-work bails, which can be built with tools available on most dairy farms, are described and illustrated.

Protection from the weather is obtained at low cost.

The feeding of young calves has to be done twice daily, and in all weathers. Any system which saves time and makes for working comfort at reasonable cost is worthwhile. You are likely to rear better calves if your handling of them is done under pleasant conditions.

Well-fed and cared-for calves are healthier, grow faster, and come into production earlier than those given less attention.

When building a new milking shed or altering the existing one, you are advised to include convenient calf feeding bails. Especially does this

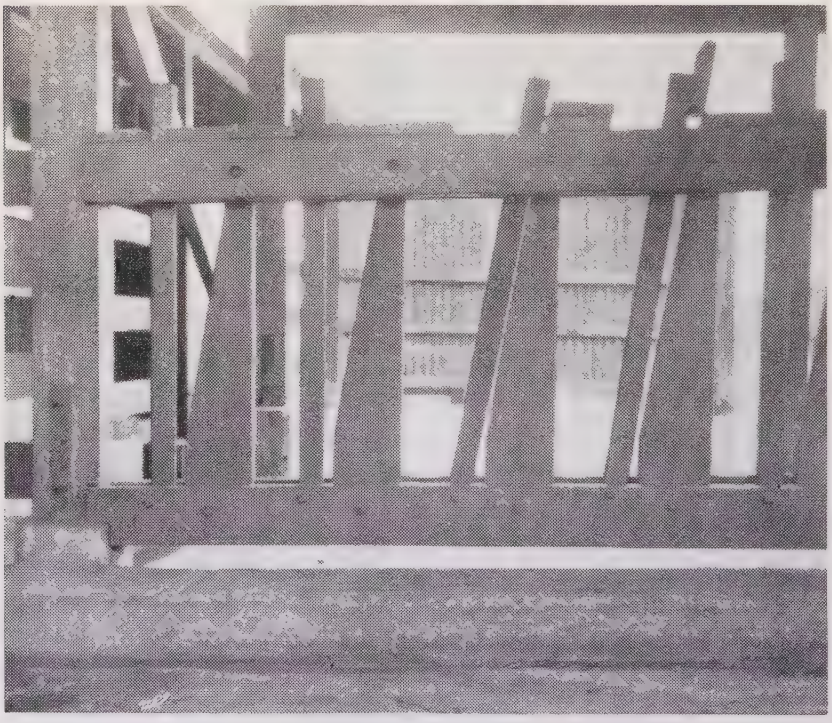

Plate 1.

These Sword-Type Bails Allow for Individual Attention in Calf Rearing.

apply in wet climates as experienced on the Atherton Tableland of North Queensland. The photographs reproduced here show feeding bails on farms in that district.

The main features are a concrete floor on which both the person doing the feeding and the calves can stand; individual sword-type bails to hold the calves; and a roof to give protection from the rain.

The roof should be high enough to allow sunlight to enter and yet provide protection from bad weather.

WATCH THE LOCATION.

There are three points to consider:

(1) Calves should not intrude upon the prescribed stock-free area around the cream or milk room.

(2) Easy access from the calf paddock to the feeding floor is required. It is preferable that separate entrances be provided for both cows and calves.

(3) Provision should be made for good drainage, but having the drain opening into the calf paddock should be avoided.

When a covered yard has been built, the calf feeding bails can often be located at one side or end of this—at little or no additional cost for roofing. The feeding floor should be as far distant as possible from the milk room.

ADVANTAGES OF SWORD BAILS.

Many advantages are to be gained from having sword-type bails. Each calf is securely held. One calf cannot

Plate 2.

The Roof Over the Calf Feeding Bails Should be High Enough to Allow Sunlight to Enter and Yet Provide Protection from Bad Weather.

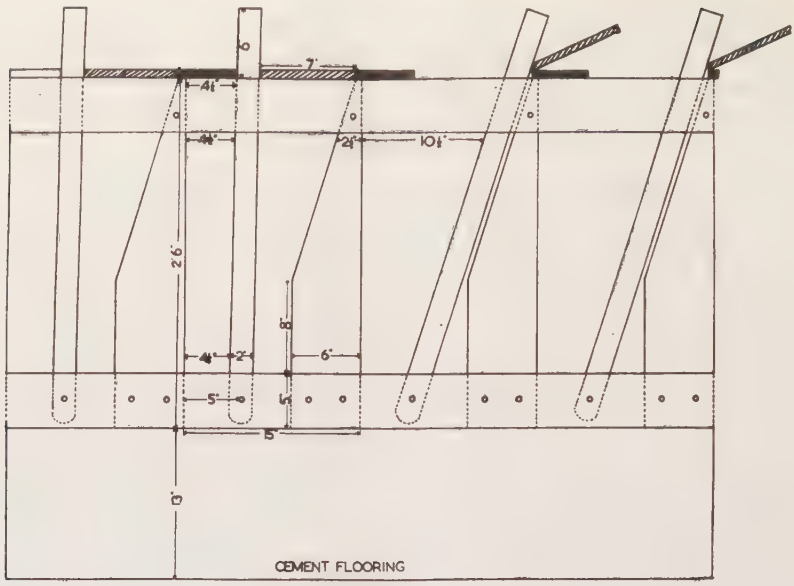

Plate 3.

Diagram of Individual Sword-Type Calf Bails.

reach into the bucket of its mate. Thus you are assured that each calf gets its proper ration and the slow drinkers are not bullied by others which finish quickly.

Calves can be safely left to drink or eat, without attention. Sometimes calves are slow in learning to take grain or meal mixtures. A useful method of teaching them can be employed in this type bail.

This consists of placing a little meal in the bottom of the bucket immediately following the drinking of the milk. In most cases the calves will soon lick up the meal. They can be left for a time with the meal in front of them. With individual bails some calves can be released and some detained if desired.

Routine operations such as tattooing, vaccinating and drenching can be done easily by one man when calves are held in the sword bail.

By careful attention to floor levels, as shown in the diagram, calves can drink comfortably without spilling milk.

CONSTRUCTION OF SWORD BAILS.

Plate 3 shows the size of the sword bails and sizes of timber which are being used by successful farmers.

You will be able to build a set yourself when the need arises.

A few points of construction are worth noting:

(1) The front horizontal cross members, and back horizontal cross members are constructed of 5 x 2 in. and 5 x 1 in. hardwood respectively.

(2) The tapered upright fixtures between the bails are made from 6 x 1½ in. hardwood. The sizes of these materials used ensures a strong structure, with a total width of 4½ in. Uprights designed with a tapered section as illustrated prevent calves from putting their heads through behind the sword.

A LETTER TO

DEAR DAD,

Thank you for your letter. Your suggestion on the drafting race did the trick, and the sheep are running well now. I have to tell you that I am becoming very interested in a certain female on this property. That will give you and Mother something to think about. "She" is a young bay filly that I broke in myself, and the Boss is letting me train for the Picnic Races. She goes back in her breeding to Carbine, but the Boss says that means nothing, as the influence of the sire becomes diluted by half over each mating. So a sire that far back has negligible influence. He says it is better that the immediate sire and dam should be good. Which brings me to an argument the boys had in the quarters. As overseer, I was asked to decide. One of the station hands has a pure-bred sheep bitch which had pups to a pure-bred dog. Some of the pups had very big paws and wide heads. The station hand blamed a previous chance mating with a cattle dog, and wanted to know if the cattle dog had ruined the bitch for future pure-breeding. I told him that this was an example of incorrect folk-lore, called "telegony." As far as I know the influence of a mating goes no further than the fertilization of the eggs, and in following pregnancies the young cannot be influenced by earlier matings. The fellow was very pleased to hear this—he is dead keen on dogs—although he lost his argument. Fortunately, I remembered you talking about this sort of thing about your dogs, so I felt I could advise.

Affectionately,

BILL.

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(3) The swords are 2 x 1 in. hardwood, 3 ft. in length. When the bail is closed the top of the sword is ¼ to ½ in. off perpendicular. This allows automatic opening when the latch is lifted.

(4) The latches are 7 in. long by 4½ in. wide x 1 in. The latch width of 4½ in. facilitates operation of the bail with one hand.

(5) Bails are erected 13 in. from the cement floor, which give the following advantages—

(*a*) The smallest calves are able to reach the bottom of the feeding container.

(*b*) Overturning of feeding containers is reduced.

(*c*) This height facilitates cleaning of the floor.

CONCLUSION.

Individual attention counts in calf rearing. You will find this easy with a set of bails as illustrated.

Sod Culture In Citrus Orchards At Gayndah

By A. J. CROCKER, Adviser in Horticulture.

During recent years, there have been some striking changes in soil management practice in some citrus growing areas. One of particular interest is the change-over from clean tillage to sod culture at Gayndah, a sub-coastal district where citrus is grown under irrigation.

During the first two or three years after the inception of sod culture in 1950, growers watched the performance of their trees very carefully for they were well aware that the change-over involved a major departure from established practice and carried some risks. Nevertheless, about 25 per cent. of the orchards in the Gayndah district are now under sod, and the number is increasing each year.

At first, it was assumed that this method of soil management would be practicable only in orchards where the trees were irrigated by permanent overhead spray systems which, unlike portable spray systems, require little labour for their operation. However, applying adequate amounts of water at the right time has proved less difficult than expected and to-day, sod culture is practised by several growers who water their trees with portable spray lines.

Plate 1.

Ellendale Mandarin Tree. One of the main varieties of citrus grown on the sands and sandy loams at Gayndah.

Advantages of the System.

The principal advantages of sod culture appear to be:—

1. The increased volume of soil effectively occupied by the roots of the tree.

In clean-cultivated orchards, the use of implements suppresses root development in the upper layers of the soil. Under sod, on the other hand, the top 6 to 8 in. of soil is filled with a dense mass of feeding roots. With these additional surface roots, the trees have access to water from light rains which do not penetrate any great distance into the soil. In addition, the ground cover keeps the soil reasonably cool even in the hottest weather, and moisture losses due to evaporation from the surface are considerably reduced. Fluctuations in soil moisture are therefore less, and this is an advantage especially during the blossoming and fruit setting periods.

2. Permanent sod makes it easier to use heavy equipment in the orchard after rain or irrigation.

In clean-cultivated orchards, several days may elapse before spray plant and similar equipment can be moved through the trees, and interruptions to pest and disease control programmes are not uncommon. Such holdups seldom occur in orchards under sod. Irrigation is also simpler than in clean-cultivated orchards where the transfer of portable mains from row to row is a wet, messy and time-consuming job.

3. Water penetration into the soil is very good in orchards under sod.

This is particularly noticeable on sloping ground where soil erosion is liable to take place in clean-cultivated orchards. The improved water penetration is due partly to the obstacle which sod presents to the movement of surface water as well as freer movement of water through the soil itself.

Plate 2.

Citrus Orchard Under Sod. Couch grass is the main species in the sward. Note the overhead irrigation system.

Plate 3.

Fertilizer Distributor in Action. The trees need additional fertilizer for 2 to 3 years after sod is established.

4. Dust deposition on the fruit and leaves of the tree is negligible in orchards under sod.

This could have an effect on the pest control programme for it is well known that populations of some species such as red scale are much greater on trees near roads or tracks where dust is constantly stirred up by vehicles and implements than in trees removed from the dust nuisance.

5. Fruit that is grown on the lower branches of the tree carries fewer blemishes in orchards under sod than in orchards where regular cultivation is practised.

Establishing the Sod.

The majority of orchards under sod at Gayndah have couch grass as the dominant species in the sward. However, legumes such as irrigation white clover and lucerne provide an excellent ground cover once they are established. Lucerne, in particular, has proved very useful for breaking up hardpan induced by cultivation before it was established and for improving water penetration through the soil during irrigation.

Clover and lucerne are planted during the April-May period. Where the orchard has been clean-cultivated previously, the ground is brought into a good tilth before the seed is sown broadcast and lightly harrowed in. If the orchard already has a grass sod, clover or lucerne can be established with a sod-seeder.

After planting, frequent irrigation is required to ensure that the young plants are well supplied with water until they are established. It is usual to apply 50 to 80 points of water every week during this period.

Prior to planting, superphosphate should be broadcast over the orchard at a rate of 1 to 1½ cwt. per acre.

Management.

The success of sod culture in citrus orchards at Gayndah depends greatly on efficient management.

Regular mowing is essential to prevent weeds from seeding, particularly under the edges of the trees and also, at times, to lessen competition between the trees and the sod for soil moisture. Various types

of mowers, both rotary and reciprocating blade types, have proved serviceable. The rotary type is very manoeuvreable and is easily powered from a tractor.

Where clover is a constituent in the sod, the mower should be operated high enough to allow the clover to flower and set seed in order to ensure regeneration from year to year.

In orchards under sod, nitrogen is applied as a soil dressing at monthly intervals during the November-March period. Rates of fertilizer application for bearing trees are: November, 2½ lb. sulphate of ammonia or nitrate of soda; December to March, 2½ lb. sulphate of ammonia or 1 lb. urea. A fertilizer distributor is very useful for applying the fertilizer but growers should not forget that approximately 60 per cent. of the tree roots are under the canopy and substantial amounts of fertilizer must therefore be placed in this position.

When sod was first established in some orchards, standard fertilizer schedules did not supply adequate amounts of plant foods for both the trees and the ground cover. As a result, the trees showed typical symptoms of nitrogen starvation until additional fertilizer was applied. However, some two years or so later, normal fertilizer schedules were usually sufficient to maintain both the trees and the sod in full vigour.

Irrigation practices had also to be modified for some time. Until the sod became established, it was invariably necessary to water the orchard more frequently than in clean-cultivated orchards on the same soil type but, once the ground cover was complete (in about two years), water consumption fell to much the same level as before.

Experience with sod culture on the sands and sandy loams of Gayndah leaves little doubt that the practice is here to stay. The problems involved in changing over from clean-cultivation or, alternatively, cultivation and cover cropping, to sod have proved less exacting than anticipated. It is agreed that no grower who has adopted this system would think of reverting to the older systems of soil management.

A Lesson From The Drought

The long dry spell which now appears to be behind us has taught us a number of lessons. Those learned the hard way are seldom forgotten.

Farmers in many parts of Queensland have spent a lot of money and time on the preparation of land, planting seed and topdressing with fertilizers in the programme of establishing improved pastures without irrigation. Last year in many cases they were a total loss.

While the seasons were normal the results were excellent.

The expenditure and time on this type of work on any farm is not only a necessity, but also shows dividends, provided it is carried out in the proper way. However, we know now that pasture improvement must be closely linked with rotational cropping and fodder conservation. Where pasture fails, a fodder crop can often be established. The three combined are sound farming practices.

—O. L. HASSELL, Senior Adviser in Agriculture.

Onion Growing In Queensland

By J. G. FULLERTON, Adviser in Agriculture.

Onion growing is not a major primary industry in Queensland, and production is confined mainly to the south-eastern part of the State.

The average annual acreage for the five-year period ending in 1957 was approximately 2,600 acres, most of this being in the Lockyer Valley, where the crop is grown almost entirely under irrigation. In recent years crop acreage has increased substantially on the Darling Downs, where it has reached 800 acres. Most of this acreage is not irrigated.

Climatic conditions permit the onion crop in south-east Queensland to be grown as a winter crop. This is an important factor, as the crop is marketed at a time which does not clash with the crops produced in southern States, and weed incidence is confined to the winter growing species.

SUITABLE SOILS.

Onions do best on fertile soils of good depth and moisture-holding capacity. They grow well on soils ranging from sandy loams to heavy, self-mulching clay loams. The

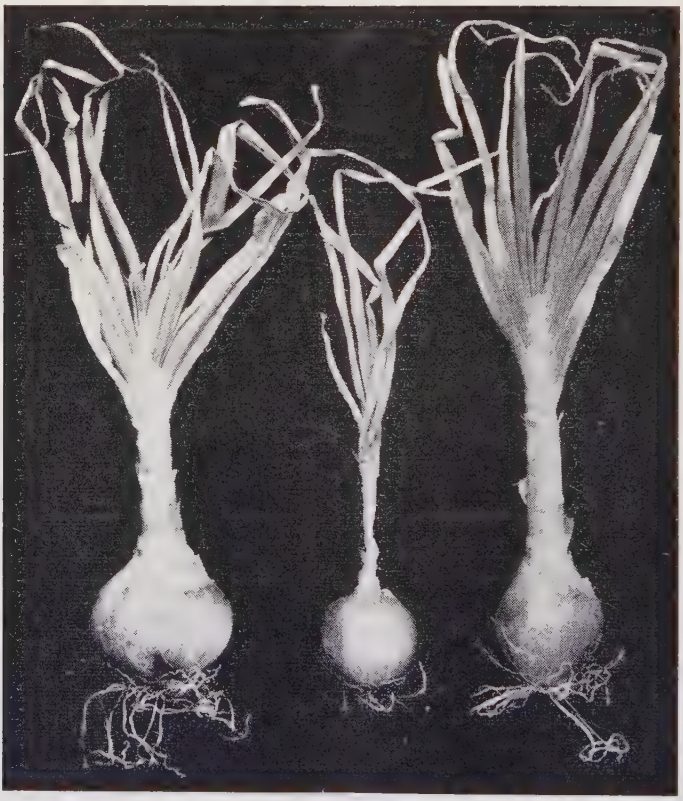

Plate 1.

"Bull Neck" or "Bottle Neck" Bulbs. The centre bulb is a good market type of onion. Poor seed and excessive irrigation on fertile heavy soils may tend to produce "Bull Necks".

Plate 2.

A 6-row Onion Planter as Used in the Lockyer District.

majority of the onion crops in the Lockyer Valley are grown on the latter type of soil, which produces a good bulb, with firm skin and good keeping qualities.

One disadvantage on this soil type is the tendency, under favourable growing conditions, for the onions to form abnormally thick necks popularly known as "bull necks" or "bottle necks". Onions of this type are not desired on the market.

Slightly acid to neutral soils are preferable for onion growing, as the plant is not tolerant of highly acid soils.

ROTATIONS.

It is a common practice to plant onions for several years on the same piece of ground. When this is done, ploughing usually follows immediately after harvesting and the land is then subsequently worked to retain moisture, and control weeds.

Onions, however, are also planted following crops of lucerne, potatoes, and green manure or cover crops. Any bulky crop which successfully smothers weeds, and when ploughed under leaves the ground in good tilth, is quite suitable as a crop preceding onions in the rotation. Crops commonly grown for this purpose are cowpeas, grain sorghum and wheat.

Onions also do particularly well following a crop of lucerne, as the weeds of lucerne, which are mostly summer growing grasses, are of minor importance in the onion crop.

The cover crop used depends chiefly upon the intended time of planting of the following onion crop, but usually they are all ploughed under prior to the onset of the wet season. A period of three to four months normally elapses between the ploughing under of the cover crop and the planting of the onion crop. Old lucerne stands, however, may need to be ploughed

Plate 3.
Onion Bulbs with Seed Stems. Such bulbs should not be marketed.

under about 12 months before the planting of the onion crop so as to allow a thorough working down of the seedbed.

Wheat and grain sorghum are often allowed to mature, and are harvested before being ploughed under. Although this may be done, their chief purpose is that of a cover crop in the rotation.

Under conditions of natural rainfall, the use of a cover crop immediately preceding the onions may not be practicable, owing to the necessity to conserve the available rainfall in the soil prior to planting the onion crop.

LAND PREPARATION.

The main problem associated with onion growing is weed control; therefore thorough working of the land is necessary to ensure a seedbed as weed-free as possible.

The importance of this point is the reason why it is common practice to grow onions for several years on the same piece of land. This has desirable aspects from the point of view of weed control, but the practice can lead to a build-up of disease in the soil, especially "pink-root".

Cultivation depends upon soil type, previous crops, seasonal conditions, and so on, but should aim at the production of a seedbed of desired fineness and condition. After the initial ploughing, subsequent cultivation is aimed at controlling weed growth, retaining soil moisture, and preparing a firm seedbed of good tilth.

Before planting, the seedbed should be completely free of weeds, two to three inches in depth, and should have a surface tilth of market-garden fineness. The subsoil should be moist and firm, but not too compact, for the onion is a fairly deep-rooting plant. Smoothing boards are frequently used to break up clods and produce a fairly firm seedbed, which facilitates planting operations.

PLANTING.

Transplanting is not practised in Queensland, the seed being sown directly in the field in drills. Some planting is still done with single-row hand planters, but the bulk of the planting is now done with motor-driven garden cultivators or with tractor-mounted planters, particularly in the Lockyer Valley. Motor-driven garden cultivators plant and cultivate three rows at a time, while the tractor-mounted planters are usually equipped to handle six rows at a time. Planting width of the drills with these machines is usually 12 to 14 in.

On the Darling Downs, satisfactory plantings have been made using combines, with baked Japanese millet as a seed carrier.

Depth of planting should not exceed one inch, if possible; the aim of most farmers is a planting depth about ¾ in.

The rate of planting varies from 1½ to 2½ lb. of seed per acre, and this is governed more by the viability of the seed than any other factor. The aim in all instances is to obtain an adequate stand, but not too thick, so that hand thinning is unnecessary. With irrigation, the desired plant spacing is approximately 3 in. If less than this the bulbs develop in crowded bunches, resulting in malformation, while a greater spacing tends to produce too large an onion. Both these types are undesirable for prime market requirements.

Under conditions of natural rainfall the plant spacing needs to be increased to 4 to 6 in., otherwise competition for available moisture may limit growth. Wider row spacing than the customary 14 in. may also be an advantage with rain-grown crops.

VARIETIES AND TIME OF PLANTING.

The time of planting and the variety selected are two factors that are very closely related. As a result of careful plant selection and the growing of their own seed supplies, onion growers in the Lockyer Valley are able to plant seed of local strains two months earlier than seed of commercial varieties.

All this local seed is of the "globe" type, which is less prone to rots at the base of the stem during the stormy conditions likely to be experienced during harvesting.

It is produced from selections originally made from the "Early

Plate 4.

Six-Row "Knife" Type Cultivating Equipment Attached to a Narrow-wheeled Tractor. This machinery is particularly suitable for large-scale inter-row cultivations.

Plate 5.

A "Bean" 8-h.p. Tractor Fitted with Toolbar with Knife-type Cultivating Feet and Spraying Equipment. Six rows can be cultivated at the one time.

Hunter River Brown Spanish" and "Hunter River Early White Globe" varieties.

The earliest plantings are made in late February, with general early plantings throughout March. These crops are harvested in late July-early-August. When early strains are used, and given suitable weather conditions, little trouble from "bolting" or seed stems is experienced.

Planting continues until June, the readily procurable commercial strains being planted then and in May also. The use of this seed earlier in the season is likely to result in a crop of seed stems, with very few marketable bulbs. Seed of globe type onions is also preferred for these later plantings due to the greater susceptibility to rotting of the flat type.

IRRIGATION.

Almost the entire crop in the Lockyer Valley is grown under irrigation, the spray method being invariably used.

The normal procedure is to plant dry, and follow with sufficient irrigation to ensure germination. On a well prepared seedbed, with adequate subsoil moisture, an application of ¼ to ½ in. is usually sufficient. A period of 8 to 10 days elapses before emergence of the seedling, and a second light irrigation may be necessary then to break down any crust that may have formed on the soil surface. At this stage, the onion plant is extremely delicate, and a poor strike can result through the formation of a surface crust.

Further irrigation will depend upon weather conditions, but the plant

should never be allowed to stop growing from lack of available moisture. Onions must be kept growing without setback, as those that commence new growth after being retarded may form split bulbs, or "doubles" as they are commonly called.

As the plant matures, applications of water may be heavier, although excessive irrigation can produce "bull necks".

CULTIVATION.

Inter-row cultivation is the method used for control of weeds between the drills. On small areas this is done with a garden wheel hoe, but for larger areas motor-driven and tractor-mounted cultivators are used. These are the same machines as those used for planting, with cultivating feet in place of planting equipment.

The use of tractor-mounted cultivators is quite recent, and has been made possible by fitting narrow lugs to steel wheels, which are readily interchangeable with the normal rubber wheels of light farm tractors. These steel-wheeled tractors have increased the area that can be handled by one man, and have also opened up possibilities for chemical weed control on a large scale.

On a well prepared seedbed, where weeds have been kept to a minimum, weed growth in the row is usually light and can be controlled by hand chipping. However, if weeds are prolific, keeping the rows clean can be a costly and time-consuming operation, and this is often the factor limiting the area planted by a grower.

It is important in inter-row cultivation to prevent hilling of the plant, as this restricts bulb development. For this reason, knife cultivators rather than tines are generally used for all inter-row cultivation.

It is essential to maintain a weed-free crop, as weeds may smother the developing plant in the early stages. In the maturing crop, heavy weed growth prevents full bulb development and ripening.

CHEMICAL WEED CONTROL.

Several chemicals are now available which can be safely used to control most of the weeds found in onions.

Sulphuric acid is still used at strengths of 4 to 6 per cent. It is readily obtainable commercially, but is dangerous to handle, and special lead-lined spraying equipment is necessary. When mixing, the acid should always be added to the water; NEVER ADD WATER to the acid, as "spurting" can occur with danger to the operator.

Dinitro compounds such as "Nocweed D" are often used, and under favourable conditions give excellent control of broadleaved weeds. These yellow chemicals stain readily, and should be handled carefully because of their toxic properties. Contact with the skin should be avoided as much as possible. Rates from 1 to 1½ gal. per acre should be applied to the weeds early on a bright calm day, the rate varying with the density of the weed growth. The directions on the container should be carefully followed, and the addition of sulphate of ammonia is necessary as an activator.

Potassium cyanate is sold as a white powder, which is applied as a spray when the young onions have reached the "hook" stage. It is safer to use than either sulphuric acid or the dinitro compounds, and can give good results against weed populations in which grasses are present. Rates of application from 10 to 15 lb. per acre should be used.

CMU is a greyish powder obtainable under trade names such as "AK100", "Karmex W", and "Muval 80". As with potassium cyanate, it is relatively non-toxic to humans, and should be applied as a spray to the soil, preferably before the weeds and

Plate 6.

Scallions Compared with a Good Market-type of Onions. Scallions commonly develop on heavy fertile soils which are irrigated excessively.

onions emerge. The herbicidal action of this chemical is through the plant roots, and a light irrigation of ½ to ¾ in. following spray application is beneficial, particularly when the soil is dry. A rate of application no higher than 1½ lb. per acre of chemical should be used, as damage to the crop might occur.

HARVESTING AND STORAGE.

Onions are mature and ready for harvest when the tops shrivel and bend over. Machine harvesting is making its appearance, but by far the larger portion of the crop is hand-harvested. The usual procedure is to sever the main onion roots with a cutter blade attached to the tool bar of a cultivator, following which the onions are pulled by hand.

The remaining roots are then clipped close to the base, while the neck is cut about ½ in. above the bulb. Sheep dagging sheers are commonly used for these operations. The bulbs are then immediately bagged in the field into open-mesh bags for market or storage.

Field curing in windrows is not practised, although the onions are sometimes allowed to stand in the bags in the field for some days before storage. This has some curing effect. If the onions are to be marketed direct from the field, curing is not practised.

An important point with harvesting is that the neck should not be clipped too close to the bulb. This would allow the entry of disease organisms.

An imported onion harvesting machine has been used on the Darling

Downs. For this machine to operate successfully it is essential that the crop be free of weeds, and the onions mature, with the tops completely shrivelled and dry.

Harvesting operations extend from late July to early December. To take advantage of favourable marketing conditions, bulbs are harvested in late July and August, when still slightly immature, with tops still green. These are used for immediate consumption, as storage qualities are poor. Later crops, harvested when mature, can be stored for several months.

Onions are stored in the open-mesh bags into which they are placed when harvested. They should be stored in well-ventilated sheds, and it is important that the bags be not too closely packed. Air must circulate freely around the bags, and regular inspections to discard diseased onions are necessary.

Yields in the vicinity of 10 to 12 tons per acre can be expected from irrigated crops, while yields from non-irrigated crops vary markedly according to the season.

FERTILIZERS.

Fertilizing of onion crops at planting is not practised in the Lockyer Valley, but on other soils a basic application may be necessary, depending upon the soil type.

If prolonged wet conditions are experienced and yellowing of the tops occurs, applications of nitrogen as either urea or sulphate of ammonia are sometimes made by growers.

GRADING AND MARKETING.

Better prices are received when onions are graded into size according to popular demand, the greatest demand being usually for medium-sized onions in preference to large bulbs. Regulations governing the sale of onions state:

"No person shall offer for sale any onions contained in a package unless in addition to compliance with the general requirements of these Regulations, the onions have been graded into one or other of three grades, namely—

"'First Quality Large'; 'First Quality Table'; or 'Picklers'; and have been graded as to size and quality, and packed in accordance with the following provisions:

"(*a*) The package shall be marked with a true designation of the grade, whether 'First Quality Large', 'First Quality Table'; or 'Picklers'; of the onions contained in the package.

"(*b*) Each external layer of onions on the top, bottom and sides of the package, whether described as 'First Quality Large', 'First Quality Table', or 'Picklers' shall be a true indication of the average grade of the onions throughout the package.

"(*c*) Onions described as 'First Quality Large' shall consist of sound, clean, well-cured onions of similar varietal characteristics, free of abnormal doubles, pipers, bottle necks, scallions, sprouts, root growths, disease, mechanical injury, dirt or other foreign matter, and reasonably free from peeled onions. Not less than ninety per centum of the total of the individual onions in each package shall be two (2) inches or over in diameter and the individual onions in the remaining percentage of the total shall not be less than one and three-quarters ($1\frac{3}{4}$) inches in diameter.

"(*d*) Onions described as 'First Quality Table' shall consist of sound, clean, well-cured onions of similar varietal characteristics, free from abnormal doubles, pipers, bottle necks, scallions, sprouts, root growths, mechanical injuries, dirt or other foreign matter, and reasonably free from peeled onions. Not less than seventy-five per centum of the total of individual onions in each package shall be

Plate 7.

An Onion Seed Plot in the Lockyer Valley.

one and five-eighths ($1\frac{5}{8}$) inches or over in diameter, and the individual onions in the remaining percentage of the total shall be not less than one and one-half ($1\frac{1}{2}$) inches in diameter.

"(*e*) Onions described as 'Picklers' shall consist of sound clean onions, one and one-half ($1\frac{1}{2}$) inches or less in diameter.

"Every package shall be legibly and durably stamped or stencilled on a prominent part of the outside of the package with the initials of the christian names and the full surnames and address of the packer and the grade in letters not less than three-quarters ($\frac{3}{4}$) of an inch in height, except that where open-mesh onion bags are used such bags shall be deemed to be marked if tags showing the above particulars are securely fixed to the bags.

DEFINITIONS.

"In this Regulation unless the context otherwise indicates the following terms have the meanings respectively assigned to them:—

"'Doubles' in relation to onions mean that an onion has more than one distinct bulb visible externally.

"'Pipers' in relation to onions means the possession of a weak or hollow centre, or onions which have developed seed stems.

"'Bottle Necks' in relation to onions means the possession of abnormally thick necks.

"'Scallions' in relation to onions means the possession of thick necks on poorly developed bulbs.

"'Peeled' in relation to onions means onions from which the outer skin has been removed."

SEED PRODUCTION.

As the success of early planted crops depends upon the use of suitable early strains of onions, most large-scale onion growers produce their own seed requirements. There is usually a surplus from these plantings which is available for sale, but only a very limited number of farmers grow seed especially for sale.

The production of seed is spread over two seasons and field selection of bulbs is practised to obtain planting material. Selection is made of early maturing bulbs, showing other desirable characteristics such as suitable shape and size (2 to 3 in. diameter) and without faults such as doubles, bottle necks, and so on.

Following harvesting these bulbs are stored in a cool, dry place away from direct sunlight. The usual practice is to store the onions in thin layers on wire-netting trays, well above ground level. This allows free circulation of air around the onions, and any rotting or shot bulbs can be readily discarded. Storage in bags is not practised, as the onions have to be held for over six months.

In May and June, bulbs are planted in a well prepared seedbed, similar in condition to that for the main crop. Rows are usually spaced 3 ft. to 3 ft. 6 in. apart, and the onions are planted at intervals of 18 to 24 in. in the rows. Wide rows are used to facilitate cultivation and to reduce disease incidence, particularly of downy mildew, by ensuring that the stand is not too dense.

In planting, a shallow furrow is made by a suitable implement, and the onion is placed in the furrow and firmed in by hand. The bulb is well covered by soil but not completely covered. Too shallow a planting allows the onions to be blown over in high winds.

From the planted bulbs numerous bulbils form, each of which sends up a shoot from which the flower head arises. The sac bursts, the flowers open and eventually seed is formed.

Little weed growth is experienced in well prepared seedbeds. Inter-row cultivation with a tractor is continued until damage to the stem is likely to occur. Hand cultivation of both the inter-row space as well as the rows is continued to keep the plots clean.

The seed in the seed-heads turns black when mature and the heads are harvested immediately, due to the likelihood of loss from summer storms. Harvesting normally occurs in November and December. The seed stem is cut approximately 12 in. below the head. The heads with stem attached are then placed in chaff bags, and hung in a cool, well-ventilated place to dry out.

Threshing takes place at any convenient time after the seed-heads have dried out. The seed-head is clipped off just above the stem button. Threshing is done by hand through a sieve,

or similar wire mesh. After threshing, the seed is winnowed and thoroughly cleaned, and a final cleaning and rough viability test are given by immersion in water.

The sound seed sinks, leaving the trash and unsound seed floating on the surface. This operation is repeated until the seed is thoroughly cleaned, after which it is dried and bagged.

It is not advisable to keep onion seed more than 12 months, as it quickly loses its viability after this period at ordinary temperatures.

Average production of seed in normal seasons would be approximately 200 to 300 lb. per acre. Few growers produce this amount, most of them being content to grow their own requirements, with a little surplus to allow for any losses.

Where weed growth is not adequately controlled the crop not only suffers from direct competition from weeds but is more subject to attack from mildew. Tall weed growth increases humidity about the plant, thus providing suitable conditions for the growth of mildew. As even mild attacks of mildew can result in a considerable reduction in viable seed produced, all possible measures for its control must be adopted.

BULB ONIONS.

The planting of small onions in January, for the production of marketable onions in June, is practised to a limited extent. The labour involved in planting these onions is considerable, and is the factor limiting the area planted. For this reason, individual plantings seldom exceed one acre, and the total area planted to this crop would seldom exceed 50 acres. Another factor which limits the total area planted is that the cultural operations for this crop are very similar to those for garlic, and most farmers prefer to plant a limited area of garlic, in preference to the same area of bulb onions.

The planting material consists of picklers from the preceding crop, bulbs of $\frac{1}{2}$ to 1 in. in diameter being used. These are the most satisfactory size, larger ones having a tendency to form split-bulbs.

Each small bulb develops normally into three to five well-shaped onions, which are harvested usually in June, or sometimes earlier. To be of value, planting of bulb onions must be made early in order that harvesting can be carried out prior to the marketing of earliest onions from the seed crop.

Cultural operations for the planting of this crop are similar to those employed in preparation for planting of the main crop. A shallow furrow is made with some suitable implement for planting. The bulbs are then planted in this furrow, by hand, and almost completely covered. Row spacing similar to that of the main crop is usual, with 3 to 4 in. between bulbs in the row. Sometimes, a wider row spacing is employed, of up to 3 ft., to allow mechanical inter-row cultivation. Plants in wider rows are still usually spaced at 3 to 4 in. intervals.

PESTS AND DISEASES.

Advice on any pest and disease problems in onions should be sought from the local office of the Department of Agriculture and Stock.

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HAVE THOSE CALVES BEEN DONE WITH STRAIN 19?

☆ ☆ ☆

To Protect Pigs From Mange and Sunburn

By K. B. HALE, Assistant Veterinary Officer.

Farmers looking for more profits from pig raising could turn their attention to complaints affecting the skins of their stock. Such ills are relatively common, but often receive little attention.

The two major skin conditions in pigs in Queensland are:

(1) Mange.

(2) Light sensitivity, sunburn or photosensitisation.

Though these conditions seldom cause death, they are of economic importance in that they reduce greatly the pigs' ability to produce human food from substances such as garbage, meat swills, and some grains. This reduced ability means more food consumed and therefore greater cost per pound of pigmeat raised.

MANGE SPOILS MARKET VALUE.

Mange is much more prevalent than is usually recognised, for, while severe cases of old chronic lesions are easily seen, light infestations, especially in coloured pigs, often go unnoticed. Unthriftiness results from severe and constant irritation. Young pigs cease to make normal growth, becoming stunted and unthrifty, and may die in severe cases. In older pigs fattening is delayed and it has been found that even when not severely affected pigs require twice as much food per pound gain in weight as they would if not infested. Further, injury resulting from scratching spoils the appearance of the dressed carcase. The value of the spoilt carcase is depreciated since it has to be skinned and marketed as a "chopper."

Cause and Symptoms.

Mange is a contagious disease caused by mites. The most common mange is sarcoptic mange caused by *Sarcoptes scabei* variety *suis*.

The first sign of mange is the development of red raised areas which, in pigs other than white pigs, are often masked by skin pigments. These areas are very irritable and lead to scratching. Lesions first appear on the ears, eyelids, snout, feet and butt of the tail. In mild cases they may be confined to these areas. In old pigs these lesions are quite common and may be so slight, and cause such little discomfort, that little attention is paid to them.

As the disease spreads over the body, itching becomes more evident and the skin becomes thickened, dry and scurfy. In more severe cases. lesions are widespread over the body and the constant rubbing on posts, troughs and rails denudes the hair, and scabs form which break and bleed on further rubbing.

The method of spread is by direct contact, the mite passing from one pig to another. Since the mite does not survive for long periods away from the pig, infestation from bedding is not so frequent. Piglets from infested sows usually begin to show evidence of infestation at weaning time.

Treatment.

The first step in treating mange in the herd is to destroy animals in poor condition as they seldom do well after such a severe setback. Segregation of obviously infested animals is

a definite advantage but treatment should not be confined to these alone as pigs not yet showing lesions will have also contracted the disease. It is very important to treat all pigs in the herd.

The most effective treatment is spraying thoroughly with a suspension of 0.125 to 0.25 per cent. gamma isomer of benzene hexachloride (BHC). This concentration is three to five times that recommended for spraying of cattle ticks. This spray is best applied by crowding the pigs into a small pen and spraying from above and below. The movement of the pigs assists in getting a good cover and working the medicament into the skin.

Cessation of rubbing within 24 hours and disappearance of lesions in a fortnight is claimed from a single application at the higher dose rate. However, it is more beneficial to treat at weekly intervals for three treatments to destroy any mites hatching between treatments. Dilutions of 0.125 per cent. are quite satisfactory where treatment is repeated.

Lime-sulphur solution is quite effective in controlling mange but the general ease of BHC treatment has tended to displace lime-sulphur.

Prevention.

Use an isolation pen for all introduced pigs plus preventive spraying even if no signs of mange are evident. Introduce treatment and isolation at the first signs of infection.

SUNBURN.

Sunburn in pigs is usually observed more in our central and northern pig raising areas of Callide and Dawson Valley, Rockhampton and further north.

This condition is mainly seen in white pigs. It seems only to occur in the hot, humid months of November to March. Most cases are seen following a series of hot, humid, cloudy days, when the pig lies out of the shade apparently because of absence of sun. Other cases are observed where pigs lie with one side in a wallow and allow the other side to receive full blast of the sun practically all day. Some feeds such as rape may also cause the condition.

The symptoms are similar to those observed in people who sunbake too long on a cloudy day, in that the skin is very red, hot and painful.

In addition, the pig may suddenly drop to a kneeling position whilst walking or drinking and stay in this kneeling position, often squealing while there, for some time. If sunburn persists, blistering and sloughing of skin may occur.

Treatment and Prevention.

The obvious treatment and prevention is to protect the skin from exposure to the sun.

The cheapest and easiest treatment is to apply sump oil to the skin whenever conditions make sunburn likely or if the condition is seen. Contrary to opinion, the oil does not burn and when it disappears leaves the skin, if anything, cleaner.

Provision of adequate shade is the prerequisite for prevention especially in hot, humid conditions.

SUMMARY.

Mange and a sunburn-like condition have been discussed. We see that:

(1) Both conditions result in lowered growth.

(2) Both can be treated readily; BHC for mange. sump oil and shade for sunburn.

(3) Isolation of new pigs and treatment of them is necessary to prevent entry of mange.

Grasstree Did This—

Plate 1.

Heifer Showing Signs of Grasstree Poisoning. The back is curved and on movement the animal swings to its left side.

Tests On Grasstree Poisoning

By W. T. K. HALL, Officer in Charge, Animal Health Station, Oonoonba.

At least two of the several species of grasstree found in Queensland have been proved poisonous to cattle.

The trouble can be avoided by keeping cattle off grasstree paddocks when the flower stalks are young.

Grasstrees are well known to stock-owners in the coastal and subcoastal districts. Their habit of growth would hardly suggest that the plants could be attractive to stock. There is a fibrous trunk, without any wood, growing up to a few feet. On the top of the trunk there is a large tuft of long, drooping, needle-like leaves, resembling the leaves of some spiky grasses.

A slender stalk bearing a spike of small white flowers at its end rises from the tuft of leaves. This stalk grows several feet long, becoming harder as it lengthens.

The name grasstree comes from the combination of trunk and tuft of grass-like leaves. The trunk is very often blackened and slightly twisted. The black, twisted trunk capped by the tuft of long leaves gives the impression of a black boy, and the grasstree is often called blackboy.

FLOWER AND STALK POISONOUS.

The leaves are too wiry to be attractive to stock. It is the flower stalks and flower spikes that cause the poisoning. If much is eaten, the gait

Plate 2.

Stand of Swamp Grasstree. Normally the flower spike is about one-third the length of the stalk on which it is borne. The numerous short spikes seen in this photograph are apparently due to grazing when the spikes were young.

of the cattle is affected, and they dribble urine instead of passing it in the ordinary way.

The gait is peculiar in that the lurch is usually to one side only, with a slight twist of the spine to that side. The result is that the animal tends to walk sideways, and may even spin in the one place until it finally loses balance and goes down.

SIMILAR DISEASES.

Grasstrees usually grow on sandy soils of low fertility, and a small palm-like plant, known as zamia, may occur on the same property.

Zamia is itself poisonous to cattle and one sign is staggering, with the hind-quarters only affected. In zamia poisoning both sides are equally affected.

Also, the deficiency of phosphate in the sandy soils causes abnormalities such as soft-bone and peg-leg.

In addition, there is an apparent muscular weakness of cattle which in some cases at least is caused by poisoning from eating carrion.

The occurrence of all these troubles in grasstree country made it difficult in the past for the stockowner to be sure that grasstree was poisonous to cattle. It is now known that the typical symptoms of grasstree poisoning are a lurching gait and dribbling of urine.

FEEDING TESTS.

Tests conducted in the past three years have shown the true symptoms of grasstree poisoning and have given some idea of the amount of grasstree needed to produce these symptoms.

The swamp grasstree, *Xanthorrhoea hastile*, which grows along the coast from 50 to 300 miles north of Brisbane,

Plate 3.

Heifer Affected by Grasstree Poisoning, Showing the Typical Urinating Posture.

produced typical symptoms after feeding between 400 and 500 lb. of chaffed flower head.

A narrow-leafed grasstree, *Xanthorrhoea* sp. aff. *media* R.Br., from the Townsville area, affected a heifer after 156 lb. had been eaten in 55 days.

In all the trials carried out, the symptoms of the disease continued to get worse for two to three weeks after feeding on grasstree was discontinued.

TO PREVENT POISONING.

The important thing to remember is that grasstree poisoning occurs only when the flower stalks are young and succulent.

Poisoning can be avoided by moving the cattle from grasstree areas when flowering starts. If there are blocks of country with little or no grasstree, they should be fenced off to provide safe grazing at the time of the year when the grasstree is producing a soft flower spike.

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Beat the gun, re-tin cream cans now.

Have you an irrigation plant? If you have, then check it now; it will have work to do.

Queensland Fauna Sanctuaries

By C. ROFF, Fauna Officer.

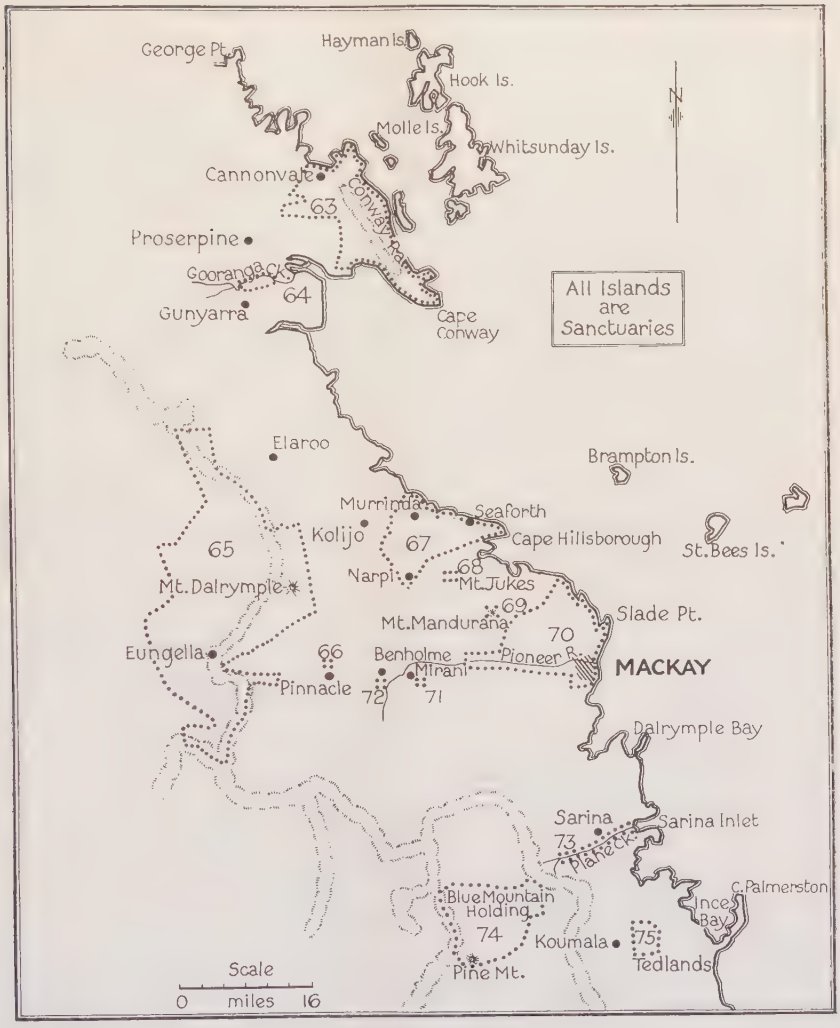
(*Continued from page 246, April, 1958.*)

The following is an index of the sanctuaries outlined in Map 10.

SANCTUARY INDEX.

Index No.	Sanctuary.	Area in Acres.
63	Funnell Bay and Jubilee Pocket, Proserpine	38,400
	State Forest Reserve 299, Parishes Conway and Dryander, via Proserpine	35,860
	National Park Reserve 227, via Proserpine	48,640
64	"Gooranga" via Proserpine	2,540
65	Property of D. A. Parker, Eungella	675
	Bee Creek, Portion 45, Parish of Eungella, via Eungella	458
	Eastern Fall of Eungella Range	32,752
	Eungella Range Timber Reserve	120,320
	State Forest Reserve 41, Parishes Crediton and Eungella	19,855
	State Forest Reserve 652, Parishes Cauley and Macartney	14,200
	National Park Reserves 44 and 573, Parishes Lacey, Mia Mia, Pelion, Gamma and Eungella	120,360
	National Park Reserve 30, Parish Eungella	11
	National Park Reserve 51, Parish Eungella	4
	National Park Reserve 55, Parish Eungella	9
	National Park Reserve 52, Parish Eungella	200
	National Park Reserve 57, Parish Crediton	2,215
66	Reserve 125, Parish of Mia Mia, via Pinnacle	109
67	Seaforth, via Mackay	50,300
	National Park Reserve 60, Parish of Ossa, Cape Hillsborough	1,620
68	National Park Reserve 616, Parish of Ossa, Mount Jukes	566
69	National Park Reserve 602, Parish of Haysden, Mount Mandurana	255
70	City of Mackay and Part of Pioneer River	63,040
71	Camping and Water Reserve 143, via Mirani	399
72	Mia Mia Camping Reserve, Cattle Creek, via Benholme	490
73	Plane Creek and its banks, Sarina	900
74	Blue Mountain Holding, Turnorville	50,400
75	"Tedlands," via Koumala	7,350

● **The wise dairyman provides good feed for dry cattle. Protein and phosphate requirements are highest now.**



Map 10.

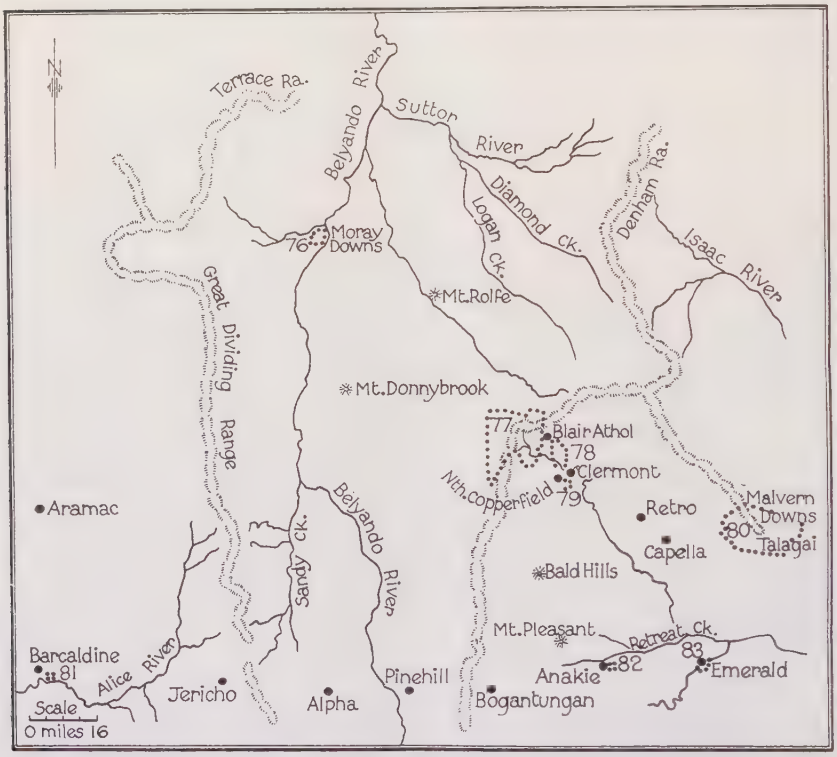
Map Showing Sanctuaries in Part of Fauna Districts Nos. 2 and 3. The sanctuary boundaries (as at 31st December, 1957) are delineated by dotted lines.

● **Feed For Prosperity. Graze oats early—12 to 15 in.—for better stooling, longer grazing.**

The following is an index of the sanctuaries outlined in Map 11.

SANCTUARY INDEX.

Index No.	Sanctuary.	Area in Acres.
76	Moray Downs Stations, via Clermont	9,200
77	State Forest Reserves 1, 5 and 127, Parishes Clyde, Moorlands, Miclere, Bathampton and Blair Athol, via Blair Athol ..	112,000
78	State Forest Reserve 117, Parishes Bathampton, Blair Athol, Aspley and Clermont, via Clermont	14,500
79	State Forest Reserve 145, Parish Copperfield, via Clermont ..	5,878
80	Malvern Downs and Talagai Holding, via Capella	128,000
81	Settlement Pocket, Alice River, Barcaldine	1,040
82	Railway Water Storage Dam, Anakie	76½
83	Nogoa River, Emerald	512



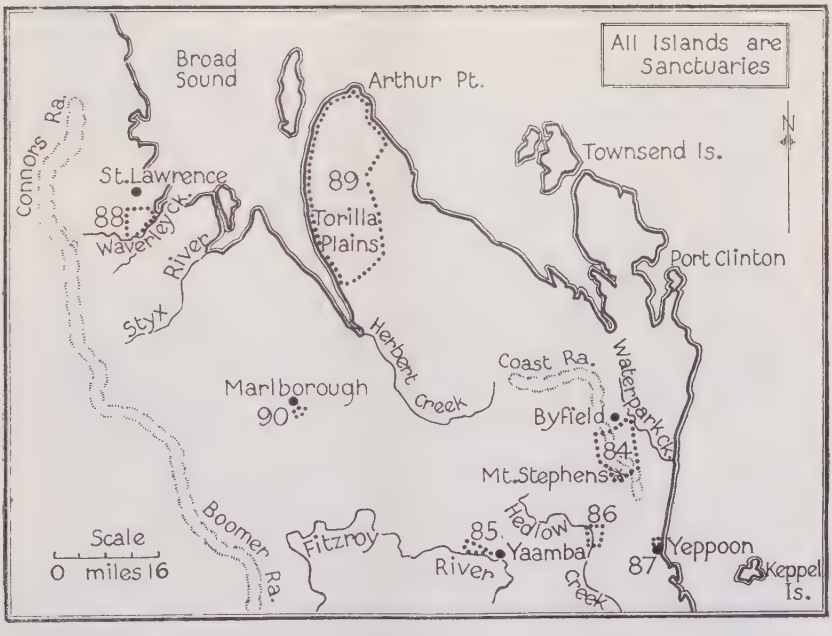
Map 11.

Map Showing Sanctuaries in Part of Fauna Districts Nos. 2 and 5. The sanctuary boundaries (as at 31st December, 1957) are delineated by dotted lines.

The following is an index of the sanctuaries outlined in Map 12.

SANCTUARY INDEX.

Index No.	Sanctuary.	Area in Acres.
84	State Forest Reserve 20, Parishes Maryvale and Byfield, via Byfield	28,135
85	Yemeappo Station, Yaamba	3,020
86	Hedlow Creek, via Rockhampton	3,600
87	The Grounds of St. Faith's School, Yeppoon	54
88	Property of C. W. Wright, via St. Lawrence	10,752
89	Torilla Plains, via Marlborough	149,200
90	Police Reserve, Marlborough	48



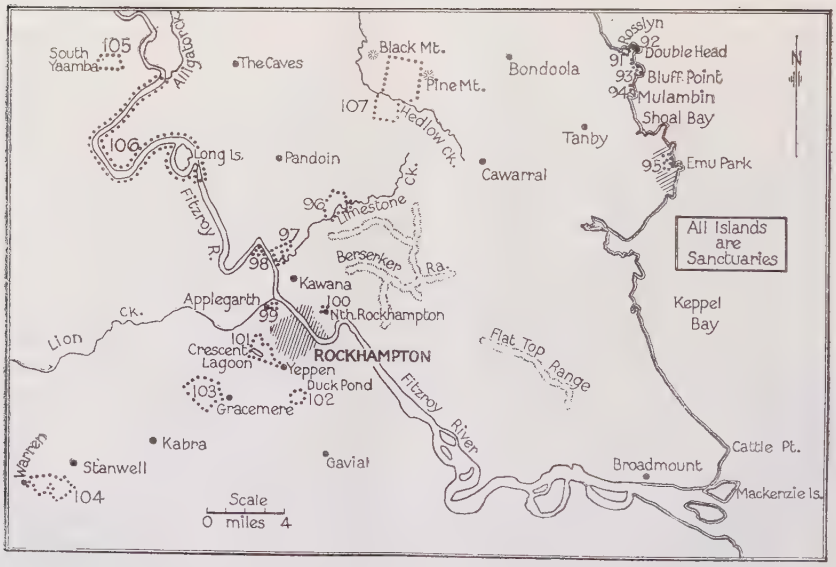
Map 12.

Map Showing Sanctuaries in Part of Fauna District No. 2. The sanctuary boundaries (as at 31st December, 1957) are delineated by dotted lines.

The following is an index of the sanctuaries outlined in Map 13.

SANCTUARY INDEX.

Index No.	Sanctuary.	Area in Acres.
91	National Park Reserve 642, Parish of Hewittville, Rosslyn Head	100
92	National Park Reserve 641, Parish of Hewittville, Double Head	28
93	National Park Reserve 643, Parish of Hewittville, Bluff Point	122
94	National Park Reserve 644, Parish of Hewittville, Mulambin	20
95	Sanctuary at Emu Park Water Reserve, Emu Park	68
96	Seeonee Park, Rockhampton	585
97	Hunter's Farm, Glenmore, via Rockhampton	349
98	Picnic Point Reserve, Rockhampton	145
99	The area previously known as Jardine's Lagoon, Rockhampton	20
100	Subdivision 11, Section 10, Parish of Archer, North Rockhampton	10
101	Diggers' Park, Rockhampton	96
	Murray's, Yeppen and Crescent Lagoons, Rockhampton ..	690
102	Duck Pond, Gavial, via Rockhampton	320
103	Native Birds Reserve, Gracemere	1,400
104	Property of S. F. Roberts, Warren, via Rockhampton	1,216
105	"Waterview," South Yaamba	570
106	Part of Fitzroy River, Belmont Creek to Alligator Creek, via Rockhampton	2,880
107	Mount Hedlow, via Rockhampton	2,137



Map 13.

Map Showing Sanctuaries in Part of Fauna District No. 2. The sanctuary boundaries (as at 31st December, 1957) are delineated by dotted lines.

[TO BE CONTINUED.]

Make Your Own Level

By R. F. Kelsey, Soil Conservation Officer.

Mr. Bill O'May, of Yamsion, has made a level that combines simplicity with accuracy—for a cost of less than £3. It is simple to construct and easy to use. Its accuracy is not affected by bumping nor rough handling.

The usefulness of an accurate level on a farm for the everyday tasks of draining waste water, levelling house stumps or running spouting is well appreciated. However, to the many farmers who have accepted, and are applying, soil conservation or irrigation practices an accurate level is not only useful but is essential.

Because of the cost of telescopic survey levels and the amount of training necessary for their efficient operation, they are not generally recommended for use by farmers.

The type of level made by Mr. O'May, and which is recommended for use by landholders, is a simple water-tube level (Plate 1). Commercial water tube levels can be purchased ready-made for £15 to £20.

The design of Mr. O'May's level has already been copied by several farmers.

Plate 1.

The Water Tube Level Constructed by Mr. O'May. There is an adjustable foot on the staff to the left of the picture.

The idea of the water level, based on the principle that "water will always find its own level if free to move" is not new, but the introduction of flexible clear plastic tubing has greatly simplified the construction of such a level, while the addition of an adjustable staff foot has greatly increased its versatility.

The water in this case is contained in a clear plastic $\frac{3}{8}$-in. tube. The ends of the tube are attached to the tops of two staffs each 5 ft. long. The staffs are marked in inches from the bottom to the top.

When the staffs are held upright, the water column at each end of the tube will rise to the same level if the ends are open (Plate 2).

The same thing applies when the staffs are separated by any distance. This distance is only limited by the length of the hose.

Whilst the tops of the water column will find a level, this does not mean that the water level will always be at the same marking on each staff. If the staff readings at water level do agree then the ground on which each staff is standing must be level.

If, however, it is noted that the water level at one staff is 54 in. from the bottom and at the other staff is 51 in. from the bottom then the first staff is standing on ground 3 in. lower than the ground level at the second staff.

It is most essential that the ends of the hoses be open before any reading is taken. Corks or other fittings for the open end of the tube are only required when it is being moved to another position.

Readings are limited by the length of the available tubing. In practice 60 ft. is the most convenient length of tubing and as 5 ft. are required on each staff the effective length of readings is approximately 50 ft.

Probably the most useful addition to Mr. O'May's level is that of an adjustable foot. This permits the surveying of a line with a set gradient or fall without any involved calculations. The gradient can be changed by simply changing the position of the extension foot.

MAKING THE INSTRUMENT.

Materials Required.

The material required for the type of level built by Mr. O'May is as follows:—

Two 5 ft. lengths of 2 in. x 1 in. pine for staffs.

One 2 ft. length of 2 in. x 1 in. pine for the extension foot.

Sixty feet of $\frac{3}{8}$ in. clear plastic tubing (price at December, 1957 approx. 8d. per foot or £2 for 60 ft.).

Two gas taps or corks to fit $\frac{3}{8}$ in. tubing.

Two three-inch lengths of $1\frac{1}{2}$ in. angle-iron drilled to take $\frac{3}{8}$ in. bolts. (If angle-iron is not available two three-inch lengths 2 in. x 1 in. pine will be satisfactory).

Four bolts (hexagonal) and nuts $1\frac{1}{2}$ in. x $\frac{3}{8}$ in.

Four bolts (hexagonal) with wing nuts $2\frac{1}{2}$ in. x $\frac{3}{8}$ in.

Four tube clips.

Construction.

The angle-iron pieces are used as bases for the staffs. One is bolted to one staff and the other to the extension foot. Whether an iron or wooden base is used the total length of base and staff must be 5 ft. In the case of the staff with the extension foot, the overall length of base, foot and staff when in zero position must be 5 ft.

The extension foot is fitted in the following way. Holes are bored with $\frac{3}{8}$ in. drill at 1 in. intervals in the foot starting at approximately 3-4 in. from the top of the angle-iron base (Plate 3).

Two holes 4 in. apart are bored at one end of the second staff, the first being approximately 1 in. from the end.

The extension foot is then fastened to the staff with bolts and wing nuts. The foot is extended by changing the bolts to other holes (Plate 3).

Another easy method of constructing the extension foot so as to permit of easy adjustment is to replace the second hole in the staff member by a guide made of metal strip which is attached to the top of the extension foot. The strip is shaped to form a rectangular loop through which the staff member can slide freely (Plate 4).

Marking the Staffs.

The staff may be calibrated in many ways but it is important to remember that both staffs must be of the same length and have uniform graduations. All markings are measured from the bottom and it is important that the adjustable staff with the extension foot

Plate 2.

Close-up View of the Staffs Showing System of Lettering Using Numerals from a Calendar.

is in the closed or zero position when being graduated. It will be found that this staff is now longer than the fixed staff and the excess may be sawn off.

Mr. O'May made sawcuts at one-inch intervals and used figures cut from a calendar to mark his staff.

Another simple way is to attach a 5-ft. tape measure to each staff with the zero mark on the bottom and the 5-ft. mark at the top.

Fixing and Filling the Tube.

The tube is fixed to the staff with tube clips (Plate 2), the top of the tube being level with the top of the staff. One clip is fixed near the top and the second half-way down.

The gas taps are screwed into the ends of the tubes. Corks or plugs of suitable size can be used instead of the taps. The tubing is then filled with water to a point six inches to one foot from the ends.

The simplest way to fill the tube and clear it of bubbles is to lay it out downhill from a filling point with both taps open. Water in then run into the tube and when the tube is full and free of bubbles the bottom tap is closed and then the top one is turned off.

OPERATION.

1. Marking a Level Line.

To mark a level line, proceed as follows:—

(*a*) Check that the extension foot is closed.

(*b*) Check that the hose ends are open.

(*c*) Check the height markings and water level by holding the staffs side by side on level ground.

Now proceed to mark the line by holding one staff upright at a selected starting point. The other staff is taken about 50 feet in the general direction in which the line is expected to run. For convenience let us call the first point A and the second point B. If the water level in the hose at B shows a higher reading on the staff than the water level at A, then the ground level at B is too low and the staff must be taken to a higher point. But should the reading at B be lower than at A, then the ground level at B is too high and the staff must be moved downhill. This operation is continued until the water level coincides with the same height measurement on both staffs. The final position of each staff is marked with a peg or other suitable object.

Having found the correct position for point B, move the first staff to this point. The second staff is again taken to the extent of the hose and the procedure is repeated. By continuing in this manner a level line of any length can be marked.

2. Marking a Line with a Fall Away from Starting Point.

To run a line with a fall of 4 in. in 100 ft. (which is 2 in. in 50 ft.) first extend the adjustable foot down 2 in., but check the amount of difference by placing both staffs together as indicated before. The operation is now the same as for the level line but it must be remembered that the set staff is placed on the starting point and the staff with adjustable foot must lead the other in the direction in which the water is to flow.

3. Marking a Line with a Fall Back to Starting Point.

If it is desired to mark a bank starting from the point where water will flow out, the procedure is slightly different. Suppose a 4 in. in 100 ft. (2 in. in 50 ft.) gradient is required. Extend the adjustable foot 2 in. Place the extended staff on the starting point and move in an estimated direction to the extent of the hose with

the set staff. Move the set staff up or down hill until the water level readings on both staffs are the same.

The procedures outlined under 2 and 3 are important when it is desired to run a line to pass close to a tree or other obstacle which may occur part-way along the desired line. A suitable position near the obstacle may be selected as a starting point. The line may then be run from that point to the outlet as outlined in 2. The operators will then return to the starting point and proceed to run the line in the other direction as outlined in 3.

A similar procedure is followed when it is desired to flow water from the centre of the paddock to both sides. This is done by starting at the discharge point on one side and proceeding as in 3 until the half-way mark is reached. From this point to the outlet on the other side the method outlined under 2 is followed.

Plate 3.

Close-up View Showing the Set Staff on the Left and the Adjustable Staff on the Right.

Remember, the extended staff must always be the one nearest the outlet end of the bank. The set staff must be nearest to the end of bank at which flow is to commence.

If in doubt close the extended foot and pick two level points as described earlier. Now extend the foot of the one staff and it will be found that this extended staff must be moved down hill for the staff readings to agree. When one staff is extended and the water levels are on the same staff marking then the extended staff must be on lower ground.

ADVANTAGES.

Advantages of a water tube level are:

(1) It is cheap to construct.

(2) It is accurate and its accuracy cannot be upset by rough handling.

(3) It is simple to use.

(4) It can be used to run a level line or one with a set fall (or gradient) without introducing any difficult calculations.

(5) Readings can still be taken even though vision between the operators is obstructed by trees or buildings.

(6) It can be used for a multitude of farm jobs.

OTHER USES.

Levelling house stumps is simple with the water tube level. Just sit the bottom of one staff on the lowest stump (or on a nail in one post which marks the height it is desired to work to). Lift the bottom of the other staff against each post in turn, marking the post at the bottom of the staff when the water level readings on the staffs agree.

By the way, you will have no trouble finding that low stump with this level.

Running the spouting around a building is not an easy job but it is greatly simplified with a water level if you follow these steps:

(*a*) Drive a nail into the fascia board anywhere.

Plate 4.

An Alternative Method of Fitting the Adjustable Foot, Using One Bolt, and a Metal Guide.

Plate 5.

Side View of the Level Showing in Plate 4. In this level a wooden base is used instead of the angle-iron base shown in Plate 3.

(*b*) Lift one staff so that the top touches the nail.

(*c*) Take the other staff to the corner or any intermediate position; lift until the water level readings on both staffs agree. Drive a nail or mark the top of the second staff at this point.

(*d*) Follow this procedure until the building has been marked.

(*e*) The markings around the building will be level and it will be necessary to mark off the required fall with a ruler from the level marks.

(*f*) To avoid having to hold the two staffs at a high position, where it would be difficult to see the readings, tack or tie a light extension strip to each staff. These must extend above the staff by exactly the same distance.

To level the bottom of two post-holes lower the staffs to the bottom of the holes. Readings on each staff can then be taken.

These are only some of the many ways the water level can be used.

FURTHER INFORMATION.

Information on gradients used in soil conservation work and other details can be obtained by writing to the Department of Agriculture and Stock, William Street, Brisbane, or applying to your local Agriculture office.

WATER FOR IRRIGATION

Water storage for irrigation is especially valuable in normal seasons when replenishment of supplies provides for continuity of pasture growth over short dry periods.

—Agriculture Branch.

Careers For Country Boys And Girls

No. 4—Forestry

By E. T. HOCKINGS, Editor of Publications.

Three ways in which it is possible to train for a career in forestry are set forth in this article. It should be noted that, in relation to forestry, the main heading under which this series is being run is partly a misnomer: forestry careers are essentially for males, owing to the physical demands made by portion of the work they are required to do.

Interesting jobs in our State forests are waiting for those trained under either of the following:

(1) Forestry Scholarship.
(2) Forest Learner Scheme.
(3) Survey Trainee Scheme.

Entry into the Queensland Forestry Department at the top level may be made through the Forestry Scholarship. This leads to work in the management of the Crown timber estate to provide for the timber requirements of Queensland.

This work includes the carrying out of forest surveys; the establishment and maintenance of nurseries and plantations of native and exotic pine; the silvicultural treatment of natural stands of cypress pine, eucalypts and rain forest species; the protection of forests and plantations from fire, insects, fungi and so on; the location, construction and maintenance of roads and of administrative buildings; the orderly sale of all products from the forest; the control and supervision of logging operations; the undertaking of research into problems associated with the growth management and utilization of forest products, and, finally, general administration duties.

Plate 1.

Tree-marking in Preparation for Plantation Thinning, Beerwah District.

[*Forestry Department photo.*

The Training.

Applications for forestry scholarships are invited after the results of the Senior Public Examination are known, and applicants should apply in writing to the Secretary, Public Service Commissioner's Department, Box 488H, G.P.O., Brisbane.

Selection is made from candidates who have sat for the Senior and matriculated in the Faculty of Agriculture. The requirements for this matriculation are passes in four subjects, including English, Maths. I., and a science subject. In addition, chemistry, physics, and a language other than English, if not passed at Senior standard, must be passed at Junior standard.

The Forestry Scholarship is a course of five years and comprises: Two years' study at the Queensland University; one year's practical training in the field; two years' training at the Australian Forestry School in Canberra.

The successful completion of the course leads to a Commonwealth Diploma of Forestry, and a degree at the Queensland University—Bachelor of Science in Forestry. It was decided in 1931 that the degree should be awarded after completion of the course leading to the diploma.

The Forestry Department requires its cadets to spend a year in the field before proceeding to Canberra, but this is not part of the degree syllabus and is not necessary for Commonwealth cadets or other students who are required to spend 48 weeks on approved field work before admission to the Bachelor's Degree.

Subjects covered in the two years at the University (pass degree) are: Physics, chemistry, botany, geology and mineralogy, mathematics (elective), agricultural chemistry, soil science, surveying, and economics.

The University in 1951 established the Degrees of Bachelor of Science in Forestry with Honours, Master of Science in Forestry, and Doctor of Science in Forestry.

Fees and Allowances.

The Forestry Department pays all prescribed fees of the scholarship holder in respect of his course of study. In addition, the following allowances are paid during the currency of the scholarship:—

Year of Course.	Living at Home.	Living Away from Home.
	Per week.	Per week.
	£ s. d.	£ s. d.
First year ..	4 0 0	6 0 0
Second year ..	4 10 0	6 10 0
Third year ..	5 0 0	7 0 0
Fourth year ..	5 10 0	7 5 0
Fifth year ..	5 15 0	7 10 0

When scholarship holders are required to undertake duty in the Department during University vacations, they are, in addition to the weekly allowances, paid a salary dependent upon the type of duties undertaken. Whilst engaged on field training during the third year of the course, payment of salary is made in lieu of the weekly scholarship allowance.

The Salary.

On completion of the course and graduation, the scholarship holder is admitted to the State Public Service

The current salary rates applying are:

—	Clerical Scale.	Cadet Scale.
	£ s. d.	£ s. d.
(*a*) First year scholarship holders employed during University vacations	524 15 0	529 15 0
(*b*) Second year scholarship holders employed during University vacations	609 15 0	619 15 0
(*c*) Third year scholarship holders employed on field training	694 15 0	704 15 0

as an Assistant Forester (commencing salary at present £1,125 per annum). He then becomes eligible for yearly increments up to a salary range of £1,530 per annum at present applying to the position of Forester, Division I., and subsequently to higher positions in the Forestry Department dependent on the availability of vacancies. It should be noted that salary rates are subject to basic wage adjustment (£49 10s. per annum at February 28, 1958), and any award variations.

Scholarship holders may further their studies beyond the scholarship course to enable them to proceed to higher degrees.

FOREST LEARNER SCHEME.

The Forest Learner scheme, which has as its object the training of youths between the ages of 15 and 19 to fill the position of Forest Overseer on the wages staff, offers to those boys who have not the necessary academic qualifications for entry to professional training, a healthy, creative, open-air life in the State's forests.

On completion of training they are employed as overseers, directing and supervising the various field operations of the Department.

Applications should be made to the Secretary, Department of Forestry, Box 1150P, G.P.O., Brisbane, or local Forests Office, giving details of age, educational qualifications, hobbies, and employment (if any) since leaving school.

Education to Junior standard is desirable but not essential.

Course and Studies.

The course comprises: First year, 6 months' hoop pine nursery experience, and 6 months' exotic nursery

Plate 2.

Planting Hoop Pine in the Monto District.

Note empty tubes from planted trees.

[*Forestry Department photo.*

experience; second year, hoop pine plantation experience; third year, exotic pine plantation experience; fourth year, 6 months' coastal hardwood experience, and 6 months' western hardwood and cypress pine experience.

In addition to the practical training provided, learners are required to do a limited degree of study of text books supplied in respect to the various phases of the work.

Payment During Training.

During training, learners are paid wage rates as prescribed: Under 17 years, £6 13s. 3d. per week; 17 and under 18, £7 19s. 11d.; 18 and under 19, £9 19s. 11d.; 19 (adult rate), £13 6s. 6d. In addition to the wage rates quoted, which are subject to any future basic wage and/or award variation, a camp allowance of 6s. 6d. per night is payable for each night spent in camp.

Avenues of Promotion.

Upon the successful completion of the training course, appointment is made as Ganger (present wage rate £14 9s. 6d. per week) for a probationary period of three months and, subject to satisfactory service, promotion is then made to Overseer, Division III., first year (present wage rate £15 2s. per week). Promotion beyond this up to Overseer, Division I. (present rate £17 17s. per week), and subsequently to the higher position of Forest Ranger on the salaried staff (classification £1,020-£1,120 per annum) is dependent on vacancies and the qualifications of applicants.

SURVEY TRAINING SCHEME.

The Survey Trainee scheme has as its object the training of youths between the ages of 16 and 19 to fill the position of Survey Overseer on the wages staff.

Work embraces the survey of forest areas and the estimate of timber thereon, the survey of forests into subdivisions and compartment, firebreak surveys, and road location surveys.

Applications should be made to the Secretary, Department of Forestry, or through the local Forests Office, giving details of age, educational qualifications, employment (if any) since leaving school.

Education to Junior standard is desirable but not essential.

Course and Studies.

The course of three years comprises: 6 months' condensed general forestry experience; 6 months' training in a south Queensland camp covering class 2 and 3 surveys; 4 months' compartment and soil surveys; 3 months' road surveys; 4½ months' forest inventory surveys on coastal hardwoods; 2 weeks in drafting branch, head office; 4 months' forest inventory surveys western Queensland, and 8 months' north Queensland surveys.

Payment During Training.

Payment whilst receiving the preliminary 6 months' condensed general forestry training is made at the rates prescribed: Under 17 years, £6 13s. 3d. per week; 17 and under 18, £7 19s. 11d.; 18 and under 19, £9 19s. 11d.; 19 (adult rate), £13 6s. 6d.

Upon placement in a survey camp for the balance of training, the rates prescribed for juniors under the Surveyors' Labourers and Cooks' Award (State Government) are payable. These rates are at present: Under 17 years, £8 4s. 9d. per week; 17 and under 18, £8 19s. 9d.; 18 and under 19, £9 15s.; 19 and under 20, £10 3s.; 20 and under 21, £11 9s. 9d.; 21 (adult rate), £13 11s. 6d.

Plate 3.

Seed Drying and Extraction (pinus elliottii) **at Beerwah Nursery.**

[*Forestry Department photo.*

Avenues of Promotion.

Upon the satisfactory completion of the training course, appointment is made as Survey Overseer Grade III. (present weekly wage rate, £15 18s.). Promotion beyond this up to Survey Overseer Grade I. (present weekly wage rate, £18 5s.), and subsequently to the higher position of Forest Ranger (Surveys) on the salaried staff (classification £1,020—£1,120 per annum), is dependent on vacancies and the qualifications of applicants.

"INTERESTING AND REWARDING."

The importance of forestry work is stressed by the Queensland Director of Forests, Mr. V. Grenning, who says: "Forestry is closely allied to agriculture in that forestry is, in effect, tree farming, but a longer period is required to produce the major crop, that is, wood.

"The forester is a manager of a large forest estate comprising 5,000,000 acres of State Forest, and 3,000,000 acres of Timber Reserve. He is concerned with the growth of the timber crop, its management and marketing, and also with research work into these matters. This involves a wide and varied field of activity.

"Timber is one of the very few natural resources which are renewable. It can be reproduced either by natural regeneration directly from seed trees in the forest itself, or by artificial regeneration, that is, by planting.

"The timber resource of Queensland has been sadly depleted. If we are to supply our future timber needs from the annual increment of the forest then the depleted forest capital must be rebuilt to a stage where the annual increment of utilizable timber (that is, interest) is adequate to supply our needs.

"This is a task of some magnitude, and this creative work is of an interesting and rewarding nature."